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WEST AFRICAN FISHERIES.

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A REVIEW
OF THE
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THE UNITED STATES
AND THE
WORK OF THE UNITED STATES FISH COMMISSION.

BY

PROFESSOR G. BROWN GOODE, M.A.,

ASSISTANT-DIRECTOR OF THE UNITED STATES NATIONAL MUSEUM,
AND COMMISSIONER TO THE INTERNATIONAL FISHERIES
EXHIBITION, LONDON, 1883.

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CONFERENCE ON MONDAY, JUNE 25, 1883.

His Excellency JAMES RUSSELL LOWELL, LL.D., the American Minister, in the Chair.

FISHERY INDUSTRIES OF THE UNITED STATES.

I.

YOUR EXCELLENCY, MY LORDS, LADIES AND GENTLEMEN,—The narratives of Columbus and the early explorers are filled with tales of the number and the diversity of the fishes in the seas and rivers of the West.

European fishermen, Basque, Norman, English, Spanish, and Portuguese, followed in the wake of discovery, and twenty-five years after the landing of Columbus the crews of fifty vessels were plying their handlines over the shoals of the New-found-land.

English mariners were accustomed, however, to resort to the cod-banks of Iceland as early as the time of Henry IV. (1400–1413), and to them, at least, the voyage to the new grounds, a few scores of leagues further from home, was not a particularly remarkable act of enterprise or daring.

The fishermen soon extended their voyages to the region now known as New England. Gosnold, in 1602, declared that about Cape Cod, from March to May, there was "better fishing, and in as great plenty, as in Newfoundland;" while his companion, Brereton, predicted that "forasmuch as merchants are diligent inquisitors after gains, they will soon remove their trade from Newfoundland."

The first American colony, planted at Jamestown in 1609, owed its permanence chiefly to the abundance of fish and oysters in the adjacent rivers. Its founder, Captain John Smith, was the pioneer of the American fisheries, and in his writings devotes many pages to the discussion of the methods by which they should be carried on. He was a practical fisherman, for his vessel in 1614 took 47,000 fish off the coast of Maine. He realised thoroughly the value of his spoils. "And is it not pretty sport," wrote he, "to haul up two pence, six pence, and twelve pence as fast as you can hale and veare a line? He is a very bad fisher cannot kill in one day with his hooke and line, one, two or three hundred cods." The colonists whom he planted on the shores of the Chesapeake have handed his precepts faithfully down to their descendants, who are to-day hauling pence up out of the water faster than their forefathers ever learned to do. The fisheries of the Chesapeake region yielded in 1880 a product valued at nearly eight and one-half million dollars.

The Massachusetts colonies were founded with still more special reference to the fisheries. We are told in Winslow's "Briefe Narrative of the True Grounds and Causes of the First Planting of New England," that when the Puritans sent agents from Leyden to King James to gain his consent to their going to America, the King at once asked "what profit might arise." They answered in a single word, "Fishing." "So God have my soul," remarked the

King, "'tis an honest trade; 'twas the Apostles' own calling."

The Pilgrims sought out a place for their settlement which "seemed to offer some advantages both for whale and cod fishery," and for two years were sustained in their struggles for food chiefly by the fish which they caught in their slight nets, and the mollusks which they dug upon the shores. They soon received better fishing appliances from England, and at the close of the third summer (1624) they sent home a ship laden with fish, cured with salt of their own manufacture.

Before the middle of the century there was a considerable fleet of ketches, barks, and snows, and at its close Massachusetts was exporting annually to the south of Europe about one hundred thousand quintals of dried codfish, of the value of $400,000.

A century later, at the beginning of the revolutionary war, the New England fishing fleet numbered 665 vessels, with crews numbering 4405 men.

The fisheries of the United States are to-day controlled by the descendants in the seventh and eighth generations of those hardy colonists from the southern coasts of Great Britain, and the greater number of the largest vessels are manned by men of English blood. Our fishing ports are known by such famous English names as Gloucester, Boston, Portland, New Haven, Fairhaven, Dover, Norfolk, Norwalk, Truro, Barnstable, Chatham, Tiverton, Yarmouth and Harwich, New Bedford, New Shoreham, and New London. Our fishes are known by familiar English names; and old English words, long abandoned in the British Isles, still survive in the dialect of our fisher-folk.

It is not inappropriate, then, that the United States established so long ago as colonies of England, upon a foundation in which the fisheries were so closely concerned, should, for the first time taking part in a British International Exhibition, select the occasion of an exhibition of the fisheries.

II.

The progress of our fisheries for the first two hundred years was comparatively slow, and their history monotonous. Little interest was manifested in them, and little was known about them by persons not directly concerned, and their development was not proportionate to that of agriculture, mining, or the industrial arts.

The cod-fishery, the whale-fishery, the mackerel, the shad and alewife, and the oyster fisheries were carried on in 1860 much in the same manner as at the beginning of the century, and their products were prepared and sent to market in accordance with methods not essentially unlike those in use among the earliest fishermen of the colonies.

The war of the rebellion (1861–65) was a serious interruption to all maritime industries, but since its close, and particularly within the past decade, the fisheries have increased in extent and value to a degree without parallel in their previous history.

The census of 1870 indicated their value to be about $11,000,000. This was an under-estimate, but at the time was accepted without challenge or criticism.

The census taken ten years later recorded a value of $44,546,000, and their product in 1883 is at least twenty-four per cent. greater, the value of the various products being fixed at the lowest prices paid "at first hand," or to the fishermen. A fair estimate at wholesale market rates, rather than upon the census basis of fishermen's prices, would at the present time probably be above, rather than below, the sum of $100,000,000.

This rapid increase is due to a number of causes which are mentioned here in the order of their sequence in time rather than in that of their relative importance.

1. The extension of railways into every part of nearly every one of the 2290 counties of our forty-four states and territories, and the consequent lessening of the cost of the delivery of food-products at a distance, has had its influences. Fresh sea-fish are now sold in cities a thousand or more miles from the sea at prices lower than that of beef or mutton. Within three years the fish production of the Gulf of Mexico has been doubled at least by the improvements in the transportation systems of the lower Mississippi Valley.

2. Still more important has been the general adoption of scientific methods of preparation and transportation. Great freezing houses have been built on the Great Lakes, on the Pacific coast, and in the cities of the East, and refrigerator cars are running upon all the trunk lines of railway. Columbia salmon, lake white-fish, cod, bass, Spanish mackerel, and other choice fishes are frozen stiff and packed up in heaps like cordwood, and can be had at any season of the year. Refrigerator cars carry unfrozen fish from sea and lake inland. Smelts and trout, packed in snow in the north, are received in New York by the car-load daily throughout the winter. Halibut are brought from the distant oceanic banks in refrigerators built in the holds of the vessels, and 12,000,000 to 14,000,000 pounds are distributed, packed in ice, to the cities of the interior. Baltimore, from September to April, sends special trains laden with Chesapeake oysters, daily, into the west, and this mollusk is a food for all classes, not a luxury, even beyond the Mississippi.

The Appert process of packing cooked food in hermetically sealed tin cans is in universal use in the North wherever the supply of fish exceeds the local demand, and "canneries" are also increasing in number in the South, where the harvest of the sea is still, for the most part, ungarnered Tinned fish, especially salmon, lobsters, and sardines, and mackerel, are extensively consumed, and at least $3,000,000 in value is annually exported. In 1880, 2,153,000 salmon were received by the establishments of the Pacific slope, and were packed in 31,453,000 one-pound cans, worth at the factories $3,255,000. "Sardines" to the value of $825,000 were packed in Maine, these being simply young herrings, mostly in cotton-seed oil of domestic manufacture. 4,178,000 pound cans of lobsters were also packed in the factories owned by Maine and Massachusetts.

Improvements in the manufacture of fish-oil and guano, in the production of which, as also in that of medicinal oil, steam is almost universally used, have been numerous and important.

The clean and attractive packages in which canned, dried, smoked, and pickled fish are now exposed for sale led also to the more extensive use of fish for food. The fish-shop of to-day is not so repulsive as of old to sight and smell. Salt codfish is no longer sent to the best markets in bulk, and more than two thousand men, women, and children are now employed in removing skin and bone and packing the fish in neatly cut strips in boxes or in tin-foil covered packages of definite size. In many inland districts the introduction of boneless dried fish in boxes and pickled fish in tins has led to increase of sales, estimated by competent authority as three-fold—this within a period of four years.

The new processes of evaporation and desiccation are certain to increase the inland consumption of sea-fish.

A waste product of some importance is founded upon the boneless fish industry, the makers of fish-glue consuming yearly over 1,000,000 pounds of fish-skins, and the production of glue and isinglass in Massachusetts in 1880 amounted to $450,000.

3. A third source of encouragement to the fishermen has been the greater attention paid by our people to the art of cookery, and the increasing fondness for the luxuries of the table. Fish is ordinarily very cheap, but extravagant prices are paid for brook-trout, and for the choicer varieties of sea-fishes such as the pompano, the Spanish mackerel, the king-fish, and the sheepshead, and especially for the earliest shad or salmon of any particular river. The importation of foreign delicacies like sardines, anchovies, and caviare, is increasing, though excellent imitations of them all are put up by our own manufacturers in large quantities, and in cans so like those imported that only experts can recognise them.

The growing taste for angling among our people has had its weight also in promoting this tendency. Still more influential have been the annual dinners of the "Ichthyophagous Club" of New York, organized for the purpose of introducing into use varieties of fish-food hitherto unrecognised. Another similar cause has been the diffusion of knowledge concerning the fisheries of other countries and the fishes elsewhere esteemed, and the dissipation by chemists of the superstition, once prevalent, that fish is not a nutritive food.

4. As a direct consequence of the extending opportunities for the disposition of the products of the Fisheries, improved apparatus and methods have been devised by which the relative expense of capture has been decreased. All devices are shown in the exhibit of the United States

in the Fisheries Exhibition; indeed, the history of the development of each special form is illustrated by examples. Among the most important may be mentioned:—

(*a*) The development of the fishing schooner to a remarkable degree in speed and adaptability, and a corresponding increase in skill and daring on the part of the sailor-fisherman; coupled with these has been the introduction of cables and anchors of such strength that the schooners can ride out by their aid the heaviest winter gales of our stormy eastern coast.

(*b*) The introduction of steam vessels into the menhaden, oyster, whale, herring, and Great Lake fisheries, over 100 being now thus employed.

(*c*) The introduction of the giant purse-seine and the machinery by which it is set, enabling our mackerel vessels to increase their individual catch tenfold,* and transferring the mackerel fishery from Canadian waters to those of the United States; instrumental also in the evolution of the menhaden fishery, with its annual product of over 1,000,000,000 of fish.

(*d*) The introduction of the lighter and cheaper cotton netting in place of the old-fashioned fabric of hemp.

(*e*) The introduction of the Norwegian gill-net into the winter cod fisheries.

(*f*) The invention of many far-reaching and destructive new forms of harpoon guns, bombs, and explosive lances for the whale fishery.

(*g*) The general introduction of pound-nets or stake-nets along the sandy coasts of the Atlantic and its estuaries for the capture of the migrating summer shoals.

(*h*) The extension of the fishing grounds to new regions, especially to greater depths, as in the case of the red-snapper fishery of the Gulf of Mexico, and in that of the halibut fishery to deep water on the outer edge of the continental plateau, and the establishment of a halibut fishery in Davis' Straits, and a cod fishery in the Choumagin Islands of Alaska and the Ochotsk Sea.

---

* A mackerel schooner now takes from 2,000 to 5,000 barrels a year, the proceeds amount to $15,000 to $38,000.

(*i*) The much more general use of the trawl-line or long-line, which, indeed, was not very extensively employed before 1855, even by the fishermen of Massachusetts. Some of our schooners now set at one time fourteen or more miles of trawl-line with 12,000 to 15,000 hooks, an immense extension having occurred within ten years.

(*k*) In the case of Gloucester, our principal port, a system of co-operative insurance, by which the loss of a vessel is divided among all the capitalists of the port, and is scarcely felt, together with a system of prompt cash payments to the fishermen at the end of each voyage, and the practice of rewarding merit by giving the command of vessels to those who seem particularly deserving, has attracted to that port daring and ambitious men from all parts of America and Europe.

(*l*) The utilization of secondary products of certain fisheries, by adding in an appreciable degree to the profits of each person engaged, has proved an important impetus. Mr. Earll has demonstrated that the secondary products in the cod fisheries amount to more than 14½ per cent. of the value of the fish as taken from the water, raising the receipts of several important ports by about $100,000 each.

(*m*) A great extension of the operations of the Government in the establishment of harbour and coast lighthouses, and life-saving stations, together with the army system of storm-warnings, from all of which the fishermen have received important benefits.

5. The general tendency to expansion has been carefully fostered by the efforts of a considerable number of enthusiastic men,—anglers, philanthropists, and statesmen,—by whom societies and journals have been established, and to which influence is due the appointment of the several government and state commissions, and the appropriation of public money for the propagation and acclimatization of useful fishes.

Especially prominent in this work has been the "American Fish Cultural Association," organized in 1871,* which, under the lead of such men as the Hon. Robert B. Rooseevelt, and Messrs. George Shepard Page, Barnet Phillips, and Eugene G. Blackford, has always led public opinion in matters connected with fishery protection and propagation, and has published a valuable series of Transactions.

The "United States Menhaden Oil and Guano Association," the "New York Fishmongers' Association," the "Boston Fish Bureau," are powerful societies, organized within ten years to direct and stimulate the progress of the industries in which their members are concerned.

6. Finally, as a result and concomitant of increased consumption, increased capture and increased public interest, we come to fish culture. The transplanting of fish was practised and advocated by Gen. Lincoln, Benjamin Franklin, and others, at the close of the last century, and Jacoby, the father of artificial culture, had correspondents in the United States as early as 1770.

Mr. Earll has kindly prepared the following brief history of the science among us:—

"The first attempt at artificial fish culture in the United

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* At first called the AMERICAN FISH CULTURISTS ASSOCIATION, changed in 1878 to the AMERICAN FISH CULTURAL ASSOCIATION, mit to membership those not actually engaged in fish culture.

States was in 1851, when Dr. Theodatus Garlick, of Cleveland, Ohio, took and impregnated eggs of the brook-trout, *Salvelinus fontinalis*, which were afterwards successfully hatched. When the news of Dr. Garlick's success became known, other parties became interested in the subject, and numerous experiments were made with eggs of the trout and other species. In 1856 public sentiment had developed sufficiently to warrant the Massachusetts Legislature in establishing a Board of Commissioners for investigating subjects relating to the fisheries, and considering the practicability of the artificial propagation of fish at the expense of the State.

"The era of practical fish culture was inaugurated in 1864 by Mr. Seth Green, who built a hatchery and engaged extensively in the work. A year later the New Hampshire Fish Commission was formed, and an attempt was made, at the expense of the State, to re-stock the salmon rivers, this being the first appropriation of public money for fish-cultural purposes. Other hatcheries were established shortly afterwards, and a number of gentlemen turned their attention to fish-cultural pursuits. Prominent among these early workers were Lyman, Green, Ainsworth, Slack, Stone, Atkins, Brackett, and Mather. By the close of 1870 ten of our leading states had established a fish commission, and money had been appropriated for the propagation of brook-trout, salmon, white-fish, lake-trout, and shad.

"In 1871 the United States Fish Commission was established. Arrangements were at once made for a thoroughly scientific investigation of the fisheries, and a little later the work of artificial propagation was begun. The operations of this Commission have increased from year to year, and much has been done in extending the range of important food-fish, and in re-stocking depleted waters. The shad has been introduced into the waters of the Mississippi Valley and the Pacific Slope; the California salmon and rainbow-trout have been placed in the Atlantic tributaries; and German carp have been distributed over the greater part of the country.

"Up to 1878 the work of the Commission was confined wholly to fresh-water and anadromous species. In this year, however, a station was established at Gloucester, Mass., for the propagation of marine species; and cod, herring, and haddock were successfully hatched. In 1880 successful experiments were made with several food-fishes from our southern seaboard.

"The following is a list of the principal species artificially hatched in the United States, with the date when, and the person by whom, the experiments were made:—

1. Brook trout, *Salvelinus fontinalis*, by Dr. T. Garlick in 1851.
2. White-fish, *Coregonus clupeiformis*, by Müller and Brown in 1857.
3. Lake trout, *Salvelinus namaycush*, by Müller and Brown in 1857.
4. Pike perch, *Stizostedium americanum*, by Müller and Brown in 1857.
5. Atlantic salmon, *Salmo salar*, by J. B. Johnston in 1864.
6. Shad, *Clupea sapidissima*, by Seth Green in 1867.
7. California salmon, *Oncorhynchus chouicha*, Livingston Stone in 1872.
8. Striped bass, *Roccus saxatilis*, M. G. Holton in 1873.
9. Land-locked salmon, *Salmo salar*, var. *sebago*, H. L. Leonard in 1873.
10. Oquassa trout, *Salvelinus oquassa*, C. G. Atkins in 1874.
11. Sea bass, *Serranus atrarius*, by Fred Mather in 1874.
12. Grayling, *Thymallus tricolor*, by Fred Mather in 1875.
13. Sturgeon, *Acipenser sturio*, Seth Green in 1875.
14. Smelt, *Osmerus mordax*, by James Ricardo in 1876.
15. Herring, *Clupea harengus*, Vinal N. Edwards in 1877.
16. Alewife, *Clupea vernalis*, by T. B. Ferguson in 1877.
17. Oyster, *Ostrea virginiana*, W. K. Brooks in 1877.

Gadus morrhua, by James W. Milner in 1878.
lock, *Melanogrammus æglefinus*, by R. Edward Earll in 1879

20. Carp, *Cyprinus carpio*, by Rudolph Hessels in 1879.
21. Spanish mackerel, *Scomberomorus maculatus*, R. Edward Earll in 1880.
22. Cero, *Scomberomorus regalis*, by R. Edward Earll in 1880.
23. Moon-fish, *Chætodipterus faber*, by R. Edward Earll in 1880.
24. Silver gar, *Belone longirostris*, Marshall McDonald in 1881.
25. Gold fish, *Carassius auratus*, by Rudolph Hessel in 1881.
26. Tench, *Tinca vulgaris*, by Rudolph Hessel in 1881.
29. Soft-shelled clam, *Mya arenaria*, J. A. Ryder, 1881.

"Within the last few years the improvements in the apparatus and methods of fish culture have been very marked. Experience has enabled the fish culturists to improve upon the old styles of boxes and troughs, and the hatching of eggs of additional species has necessitated the invention of new forms.

"The improvements in apparatus for heavy eggs, like those of the trout and salmon, have been chiefly in the direction of economy of space and convenience of handling. The hatching-box used by Dr. Garlick, a simple rectangular trough, was soon replaced by the glass grill, introduced from Europe. Later still came the Clark trough, Holton box, Atkins' trough, Stone basket, and Ferguson jar. Models of each of these may be seen in the United States Department at the Fisheries Exhibition.

"Semi-buoyant eggs, like those of the shad and white-fish, are treated in a manner peculiarly Trans-Atlantic. The first, and for some years the only apparatus employed, was the floating box, invented by Seth Green. Next came the Bryan box, and later the Bell and Mather cone, Chase's jar, Clark's jar, Ferguson's bucket, McDonald's jar, and Bower's trough.

"Adhesive eggs, like those of the smelt, herring, and perch, are successfully hatched in the Ricardo and Clark boxes, and their manipulation is greatly facilitated by the aid of the McDonald egg-reel. Floating eggs, including those of the cod, Spanish mackerel, and moonfish, are hatched in floating boxes so arranged as to utilise the action of the waves, and in apparatus invented by Clark and Chester. A description of these, or indeed of any of the forms of apparatus above mentioned, is wholly unnecessary, as full-size apparatus, or working models of the same, may be seen in the Fish Cultural Department of the United States Exhibit in the Fisheries Exhibition.

"Beside the improvement of apparatus, radical changes have been made in the methods of fish culture. The most important of these is the building of movable floating hatcheries, in the form of barges and steamers, by the United States Fish Commission. By means of these, different spawning grounds may be visited during the same season, and the result of the work enormously increased, with a comparatively small increase in its cost. The application of steam for pumping the water and for working the apparatus is also of great value. Equally important with these is the improvement in the methods of transportation. Formerly the fish were carried in small quantities in the baggage-cars of ordinary passenger-trains, but refrigerator cars, built expressly for the purpose, are now almost exclusively employed. Trained experts are placed in charge of these cars, and immense numbers of fish are now distributed with small loss and a great reduction in cost as compared with the old method."

In 1866, Massachusetts organised the first state commission. All except eleven states and territories now have similar organizations. In the accompanying table, prepared by Mr. C. W. Smiley, are shown the dates of organization of the several state commissions, together with the appropriations up to 1880. A similar table, complete to 1883, has been prepared, but has not yet been received in London.

TABLE of PUBLIC APPROPRIATIONS for the UNITED STATES FISH COMMISSION and for TWENTY-EIGHT STATE COMMISSIONS.

NOTE—Arkansas, Oregon, Tennessee, Texas, and Washington, have fish commissions, but have never made any appropriation. In North Carolina the Commissioner of agriculture is ex-officio Commissioner of the Fisheries, and the expense is defrayed from the agricultural appropriations. The remaining eleven states and territories—Arizona Dakota, Delaware, Florida, Idaho, Indiana, Louisiana, Mississippi, Montana, New Mexico, and Utah—have never had state commissions

UNITED STATES, 1871–9		476,200
EASTERN STATES (6).		
Maine, 1867–80	36,975	
New Hampshire, 1866–79	22,663	
Vermont, 1871–9	7,800 ?	
Massachusetts, 1866–79	80,500	
Rhode Island, 1870–79	10,500	
Connecticut, 1868–80	43,300	
	———	201,738
MIDDLE STATES (3).		
New York, 1868–79	165,000	
New Jersey, 1872–80	29,500	
Pennsylvania, 1873–80	99,630	
	———	294,130
SOUTHERN STATES (6).		
Maryland, 1874–80	76,500	
Virginia, 1875–79	15,000	
West Virginia, 1877–79	3,900	
South Carolina, 1879	800	
Georgia, 1876–79	2,000	
Kentucky, 1876–80	11,000	
	———	109,200
WESTERN STATES (13).		
Ohio, 1873–80	29,000	
Illinois, 1880–81	3,000	
Michigan, 1873–80	53,000	
Wisconsin, 1873–80	38,860	
Minnesota, 1874–80	22,500	
Iowa, 1874–81	22,750	
Missouri, 1877–80	7,000	
Kansas, 1877–80	2,000	
Nebraska, 1879–80	1,000	
Colorado, 1877–80	2,400	
Nevada, 1877–80	5,000	
California, 1870–79	37,000	
Wyoming, 1880	1,600	
	———	225,110
		1,306,378

III.

The entire number of fishes inhabiting the waters of the United States is about 1400. Over 300 of these have a recognised economic value. There is also the usual number of species of whales and seals, several reptiles of industrial importance, and an abundance of mollusks and crustaceans, though, with the exception of the oyster, the clams, the lobster and the blue-crab, the value of these is at present not fully realised.

With a coast-line of nearly 7000 miles,* extending almost from the tropics to the pole, and with fishing fleets in Arctic, Temperate and Tropical Seas, the United States has fisheries corresponding to every kind known elsewhere, except the pearl and the coral fisheries. In hardly any direction have the fisheries reached their fullest development, and many important species, in good esteem elsewhere, are here totally neglected; skates are despised, and millions of pounds annually thrown away. The weight of edible fish taken from the waters of the United States in 1880 is over 1,500,000,000 pounds. This estimate does not include the product of the inland fisheries, other than those of the great lakes, nor the shells of the mollusks.

IV.

Fishing Grounds.—The off-shore fisheries are prosecuted on the great oceanic banks extending from Nantucket to Labrador, and upon the ledges and shoals between these and the coast.

The great Purse-seine fisheries for mackerel and menhaden are carried on north of Cape Hatteras at distances from the shore varying from one mile to one hundred and fifty miles. The fishing-grounds in the Gulf of St. Lawrence, formerly frequented by many hundreds of American vessels, have been entirely abandoned since the introduction of the Purse-seine. The oyster fishery is located for the most part between Cape Hatteras and Cape Cod, chiefly in the great inland bays. In all the great rivers of the Atlantic coast are fisheries for the anadromous shad and the two species of alewife. About the Keys of Southern Florida is an extensive sponge fishery, and on the shoals of the Gulf of Mexico the red snapper and grouper fisheries are yearly increasing in value. The fur-seal fishery is chiefly located upon the Pribylov Islands of Alaska. A small fleet of vessels yearly penetrates to the ice-bound islands of the Antarctic for seal-skins and sea-elephant oil. The whaling fleet, with head-quarters at New Bedford and San Francisco, in the main frequent the North Pacific, though a number of smaller vessels, many of them from Provincetown, pursue the sperm whale in tropical waters. The salmon fishery is seated chiefly upon the Columbia River and its tributaries, though other rivers in Oregon and California produce large quantities of salmon, which is extensively "canned" and exported. The most valuable product of the Great Lake fisheries is the whitefish.

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* The coast-line, not including that of Alaska, nor of the bays and sounds, with the exception of Long Island Sound, is stated by the Coast and Geodetic Survey to extend to a length of 5013 miles.

Fishing Towns and Fishermen.—The principal fishing ports are on the eastern coast north of the entrance to Chesapeake Bay: San Francisco has a large interest in the seal and whale fisheries and is a mercantile centre of the salmon canning interest, while Pensacola and New Orleans and Key West are local centres for the fisheries of the Gulf of Mexico. Baltimore and Norfolk control the oyster fishery; Greenport, Tiverton, and New London, the menhaden industry; New Bedford, Provincetown and Edgartown the whale fishery; and New London and Stonington the sea-elephant fleet of the Antarctic. Eastport and Portland are the most prominent lobster centres; and Eastport practically controls the sardine industry.

The general fisheries are becoming concentrated in a few cities, and while formerly fifty small local fleets were recognised, the commercial fisheries are now carried on chiefly from Gloucester, Portland, Boston, though Provincetown, with Boothbay and some other minor ports of Maine, must still be recognised. New York, Philadelphia, Norfolk, Savannah, and San Francisco have market fleets of some importance.

Fishermen.—For every man engaged in the fisheries there is at least one other man who is dependent to a considerable extent upon his labours for support. To the class of "shoresmen" belong (1) the capitalists who furnish supplies and apparatus for the use of the active fishermen; (2) the shopkeepers from whom they purchase provisions and clothing; and (3) the skilled labourers who manufacture for them articles of apparel, shelter, and the apparatus of the trade. In addition to the professional fishermen, there is a large class of men who have been called "semi-professional" fishermen—men who derive from the fisheries less than half of their entire income. Taking into account all those persons who are directly employed in the fisheries for a larger or smaller portion of the year, those who are dependent upon fishermen in a commercial way for support, and the members of their families who are actually dependent upon their labours, it cannot be far out of the way to estimate the total number of persons dependent on the fisheries at from 800,000 to 1,000,000.

Of the twenty-nine states and territories whose citizens are engaged in the fishery industry, sixteen have more than a thousand professional fishermen. The most important of these states is, of course, Massachusetts, with 17,000 men.

The majority of our fishermen are native-born citizens of the United States, although in certain localities there are extensive communities of foreigners. Most numerous of these are the natives of the British provinces, of whom there are at least 4000 employed in the fisheries of New England. There are, probably, not less than 2000 Portuguese, chiefly the natives of the Azores and of the Cape Verd Islands. Very many of the Portuguese have brought their families with them, and have built up extensive communities in the towns whence they sail upon their fishing voyages. There are also about 1000 Scandinavians, 1000 or more of Irish and English birth, a considerable number of French, Italians, Austrians, Minorcans, Slavs, Greeks, Spaniards, and Germans. In the whaling fleet may be found Lascars, Malays, and a large number of Kanakas, or natives of the various South Sea Islands. In the whale fishery of Southern New England a considerable number of men of partial Indian descent may be found, and in the fisheries of the Great Lakes—especially those of Lake Superior and the vicinity of Mackinac—Indians and Indian half-breeds are employed.

The salmon and other fisheries of Puget Sound are prosecuted chiefly by the aid of Indian fishermen. In Alaska, where the population depends almost entirely upon the fisheries for support, the head of every family is a professional fisherman, and, upon a very low estimate, one-fourth of the inhabitants of Alaska should be considered as fishermen. Few of them catch fish for the use of others than their own immediate dependents. Only one Chinaman has, as yet, enrolled himself among the fishermen of the Atlantic coast, but in California and Oregon there are about 4000 of these men, all of whom, excepting about 300, are employed as factory hands in the salmon canneries of the Sacramento and Columbia basins. The 300 who have the right to be classed among the actual fishermen, live for the most part in California, and the product of their industry is, to a very great extent, exported to China, although they supply the local demands of their countrymen resident on the Pacific coast.

The negro element in the fishing population is somewhat extensive. We have no means of ascertaining how many of this race are included among the native-born Americans returned by the census reporters. The shad fisheries of the South are prosecuted chiefly by the use of negro muscle, and probably not less than 4000 or 5000 of these men are employed during the shad and herring season in setting and hauling the seines. The only locality where negroes participate to a large extent in the shore fisheries is Key West, Fla., where the natives of the Bahamas—both negro and white—are considered among the most skilful of the sponge and market fishermen. Negroes are rarely found, however, upon the sea-going fishing vessels of the North. There is not a single negro among the 5000 fishermen of Gloucester, and their absence on the other fishing vessels of New England is no less noteworthy.*

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* Prof. Goode referred also to the mental and physical traits of the New England fishermen, their enterprise as shown in their readiness to adopt improved methods, their intelligence and public spirit. He spoke also of the education of the young fishermen, and the injury to good seamanship resulting from the custom of deferring the shipment of boys who formerly entered the business at the age of ten or twelve

There is, however, a considerable sprinkling of negroes among the crews of the whaling vessels of Provincetown and New Bedford, the latter alone reporting over 200. These men are, for the most part, natives of the West India Islands, such as Jamaica and St. Croix, where the American whalers engaging in the Atlantic fishery are accustomed to make harbour for recruiting and enrolling their crews. As a counterpart of the solitary Chinamen engaged in the Atlantic fisheries we hear of a solitary negro on the Pacific coast, a lone fisherman, who sits on the wharf at New Tacoma, Washington Territory, and fishes to supply the local market.

The number of foreign fishermen in the United States, excluding 5000 negroes, and 8000 Indians and Esquimaux, who are considered to be native-born citizens, probably does not exceed 10 to 12 per cent. of the total number, as is indicated by the figures which have already been given. Considerably more than one-half of the fishing population of the United States belongs to the Atlantic coast north of the capes of Delaware; of this number at least four-fifths are of English descent. They are by far the most interesting of our fishermen, since to their number belong the

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but who now remain on shore until they are fifteen or sixteen, and have had their perceptive faculties dulled by school training. Reference was made to the morality of the fishermen, the strict observance of the Sabbath to be met with among large classes of them, and the entire absence of ardent spirits on the fishing vessels. The character of their favourite books and newspapers, their amusements, their dialect and their superstitions were discussed. The chief diseases were noted to be dyspepsia and rheumatism. They are, as a rule, long lived, though the fishing population of large ports like Gloucester is decimated by disaster every year or two. The financial profits vary from $1000 to $100 a year for each man, though sometimes a year's work results solely in an embarrassing burden of debts.

20,000 or more men who may properly be designated the "sailor fishermen" of the United States,—the crews of the trim and swift-sailing vessels of the sea-going fishing fleet which ought to be the chief pride of the American marine, and which is of such importance to our country as a training school for mariners, and as a medium through which one of the most valuable food resources of the continent is made available.

Statistics.—By statistics prepared for the tenth census, an abstract of which is herewith presented, it has been shown that the number of persons employed in the fishery industries of the United States was 131,426, of whom 101,684 were fishermen, and the remainder shoresmen. The fishing fleet consisted of 6605 vessels (with a tonnage of 208,297·82) and 44,804 boats, and the total amount of capital invested was $37,955,349, distributed as follows:—Vessels, $9,357,282; boats, $2,465,393; minor apparatus and outfits, $8,145,261; other capital, including shore property, $17,987,413.

The value of the fisheries of the sea, the great rivers and the Great Lakes, was placed at $43,046,053, and that of those in minor inland waters, at $1,500,000—in all, $44,546,053.

The fisheries of the New England States are the most important. They engage 37,043 men, 2066 vessels, 14,787 boats, and yield products to the value of $14,270,393.

Next to New England in importance are the South Atlantic States, employing 52,418 men, 3014 vessels (the majority of which are small, and engaged in the shore and bay fisheries), 13,331 boats, and returning products to the value of $9,602,737.

Next are the Middle States, employing in the coast fisheries 14,981 men, 1210 vessels, 8293 boats, with products to the amount of $8,676,579.

OF PRODUCTS BY FISHERIES.

Value of Products.	hery.	Menhaden Fishery.	Oyster Fishery.	Sponge Fishery.	Marine Salt Industry.	
43,046,053	,813	$2,116,787	$13,403,852	$200,750	$305,890	
14,270,393	,851	539,722	1,478,900	..	3,890	
8,676,579		1,261,385	4,532,900	..	..	
9,602,737		315,680	7,068,852	..	..	
1,227,544		..	313,200	200,750	..	
7,484,750	,962	..	10,000	..	302,000	
1,784,050		..	..	..	..	
119,275		..	44,950	..	..	1
2,661,640	,500	..	..	..	..	2
1,860,714	,750	..	..	..	302,000	3
1,456,866	,851	256,205	672,875	..	..	4
997,695		941	687,725	..	..	5
643,227		..	15,950	200,750	..	6
119,993		..	35,000	..	..	7
60,100		..	..	..	..	8
32,740		..	..	..	..	9
392,610		..	200,000	..	..	10
3,614,178		..	37,500	..	..	11
5,221,715		11,851	4,730,476	..	..	12
8,141,750		61,769	405,550	..	3,890	13
716,170		..	..	..	..	14
5,200		..	..	..	..	15
22,540		..	10,000	..	..	16
176,684		..	6,050	..	..	17
3,176,589		146,286	2,080,625	..	..	18
4,380,565		1,114,158	1,577,050	..	..	19
845,695		..	60,000	..	..	20
518,420		..	..	..	..	21
2,781,024	,300	..	..	..	..	22
320,050		..	187,500	..	..	23
880,915		221,748	356,925	..	..	24
212,482		..	20,000	..	..	25
128,300		..	47,300	..	..	26
3,124,444		303,829	2,218,376	..	..	27
181,372	,412	..	10,000	..	..	28
253,100		..	..	..	..	29

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Next are the Pacific States and Territories with 16,803 men, 56 vessels, 5547 boats, and products to the amount of $7,484,750. The fisheries of the Great Lakes employ 5050 men, 62 vessels, and 1594 boats, with products to the amount of $1,784,050. The Gulf States employ 5131 men, 197 vessels, and 1252 boats, yielding products to the value of $545,584.

V.

Enumeration of the Fishery Industries.—There is a considerable number of distinct and separate fisheries and fishery industries, each with apparatus, methods, personnel, and products peculiar to itself. For convenience of discussion, these may be grouped under forty-seven heads, as follows:—

A. OCEAN FISHERIES.—(*Fishermen living on the Vessels and making Long Voyages when necessary.*)

1. The Whale Fishery.
2. The Antarctic Seal and Sea Elephant Fishery.
3. The Grand Bank Cod Fishery.
4. The Georges Bank Cod Fishery.
5. The Alaskan Cod Fishery.
6. The Winter Haddock Fishery.
7. The Fresh Halibut Fishery.
8. The Salt Halibut Fishery.
9. The Mackerel Fishery.
10. The Swordfish Fishery.
11. The Hake and Cusk Fishery.
12. The Red Snapper and Grouper Fishery.
13. The Menhaden Fishery.
14. The Herring Fishery and Sardine Industry.

B. COAST FISHERIES.—(*Chiefly from Small Boats*).

15. The New England Shore Cod Fishery.
16. The Mullet Fishery.
17. The Eel Fishery.
18. The New England Pound and Trap Fishery.
19. The Lobster Fishery.
20. The Crab Fishery.
21. The Prawn and Shrimp Fishery.
22. The Oyster Fishery.
23. The Scallop Fishery.
24. The Sponge Fishery.
25. The Sea Otter Fishery.
26. The New England Shore Fishery.
27. The Middle States Shore Fishery.
28. The S. Atlantic Shore Fishery.
29. The Gulf Shore Fishery.
30. The California Shore Fishery.

C. River and Lake Fisheries.

31. The Shad and Alewife Fisheries.
32. The Western Salmon Fishery.
33. The Eastern Salmon Fishery.
34. The Great Lake Whitefish Fishery.
35. The Smelt Fishery.
36. The River Sturgeon Fishery.
37. The Lake Sturgeon Fishery.
38. The General Great Lake Fishery.
39. The Inland Lake and Creek Fishery.

D. Strand Fisheries and Shore Industries.

40. The Alaska Seal Fishery.
41. The Turtle and Terrapin Fishery.
42. The Clam Fishery.
43. The Quahog Fishery.
44. The Abalone Fishery.
45. The Irish Moss Industry.
46. The Marine Salt Industry.
47. The Seaweed Industry.

Grouping the fisheries by their value, they stand somewhat as follows :—

A. Producing over $1,000,000.*

The Oyster Fishery	$13,439,000
The Cod Fisheries	4,000,000
The Pacific Salmon Fishery	3,300,000
The Whale Fishery	2,636,000
The Menhaden Fishery	2,117,000
The Alaska Fur Seal Fishery	1,541,000
The Mackerel Fishery	1,501,000
The Inland Lakes and Creek Fishery . .	1,500,000
The Shad and Alewife Fishery	1,500,000
The Herring and Sardine Fishery . . .	1,130,000
The Clam and Quahog Fishery	1,014,000

B. Producing from $500,000 to $1,000,000.

The Great Lake Whitefish Fishery	$900,000
The Lobster Fishery	732,000
The Great Lakes General Fishery	600,000
The Shore Fishery of the Middle States . .	600,000
The Weir and Trap Fishery of New England .	600,000
The Sea Otter Fishery	600,000

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* These values are approximate estimates only, and are subject to revision.

C. PRODUCING $100,000 TO $500,000.

The Halibut Fishery	$447,000
The California Shore Fishery	370,000
The Crab Fishery	328,000
The Marine Salt Industry	306,000
The Winter Haddock Fishery	295,000
The Sturgeon Fisheries	237,000
The Mullet Fishery	225,000
The Shrimp and Prawn Fishery	209,000
The Sponge Fishery	201,000
The Eel Fishery	190,000
The Abalone Fishery	128,000
The Antarctic Seal and Sea Elephant Fishery	112,000
The Gulf Shore Fishery	

D. PRODUCING $15,000 TO $100,000.

The Hake Fishery	$90,000
The South Atlantic Shore Fishery	85,000
The Scallop Fishery	50,000
The New England Shore Fishery	50,000
The Red Snapper and Grouper Fishery	48,000
The Smelt Fishery	48,000
The Turtle and Terrapin Fishery	45,000
The Mussel Fishery	37,000
The Flounder Fishery	30,000
The Scallop Fishery	29,000
The Swordfish Fishery	28,000
The Eastern Salmon Fishery	22,000
The Seaweed Industry	19,000
The Irish Moss Industry	16,000

VII.

There are certain among the fisheries just enumerated which are peculiar to the United States, or are interesting to the people of Europe on account of special methods employed in their prosecution. Concerning these some detailed information will perhaps be acceptable.

The Oyster Industry.—The oyster fishery is the largest upon the list. It employs 52,805 persons, and yielded, in

1880, 22,195,370 bushels, worth to the producer $9,034,861. There is to be considered an enhancement on 13,047,922 bushels, in passing from producers to market. This enhancement, which amounts to $4,368,991, results either from replanting or from packing in tin cans, and increases the value of the products to $13,438,852. This fishery employs 4155 vessels, valued at $3,528,700, and 11,930 boats. The actual fishermen number 38,249, the shoresmen 14,556. About 80 per cent. of the total yield is obtained from the waters of Chesapeake Bay. A speedy extermination of this most valuable mollusk will doubtless result unless some effective means of protection and artificial culture are soon employed.

The following statistical summary shows the volume of the oyster industry of the whole country :—

TABLE showing, by STATES, the PERSONS EMPLOYED, CAPITAL INVESTED, and VALUE of PRODUCTS in the OYSTER INDUSTRY.

States.	Grand Total.			Persons Employed.		Apparatus and Capital.		
	Number of Persons employed.	Bushels of Oysters produced.	Value of Oysters as sold.	Fishermen.	Shoresmen.	Total capital invested in Oyster Industry.	Number of Vessels.	Value of Vessels.
Total	52,805	22,195,370	$13,438,852	38,249	14,556	$10,583,295	4,155	$3,528,700
Maine	15	. .	37,500[1]	5	10	4,210	1	3,000
New Hampshire	9	1,000	6,050	6	3	2,400	. .	. .
Massachusetts	896	36,000	405,550	409	487	303,175	56	227,000
Rhode Island	650	163,200	356,925	300	350	110,000	. .	. .
Connecticut	1,006	336,450	672,875	672	334	361,200	100	69,000
New York	2,724	1,043,300	1,577,050	1,958	766	1,013,060	426	397,000
New Jersey	2,917	1,975,000	2,080,625	2,605	312	1,057,000	575	530,000
Pennsylvania	. .	.	187,500[1]	. .	. .	. .	. .	. .

[1] This quantity represents only the enhancement, the first cost being included in the Maryland and Virginia statistics.

TABLE showing, by STATES, the PERSONS EMPLOYED, CAPITAL INVESTED, &c.—*continued.*

States.	Grand Total.			Persons Employed.		Apparatus and Capital.		
	Number of Persons Employed.	Bushels of Oysters Produced.	Value of Oysters as Sold.	Fishermen.	Shoresmen.	Total Capital Invested in Oyster Industry.	Number of Vessels.	Value of Vessels.
			Dollars.			Dollars.		Dollars.
Delaware . . .	1,065	300,000	687,725	820	245[1]	145,500	65	50,000
Maryland . . .	23,402	10,600,000	4,730,476	13,748	9,654[2]	6,034,350	1,450	1,750,000
Virginia	16,315	6,837,320	2,218,376	14,236	2,079[3]	1,351,100	1,317	460,950
North Carolina . .	1,020	170,000	60,000	1,000	20	68,500	90	22,500
South Carolina . .	185	50,000	20,000	175	10	12,250	10	2,500
Georgia	350	70,000	35,000	300	50	18,500	..	..
Florida	166	78,600	15,950	140	26	22,000	..	..
Alabama . . .	300	104,500	44,950	250	50	16,000	20	6,000
Mississippi . . .	60	25,000	10,000	50	10	3,000	..	..
Louisiana . . .	1,400	295,000	200,000	1,300	100	36,750	45	10,750
Texas	240	95,000	47,300	200	40	17,750	..	..
Washington Ter. .	85	15,000	45,000	75	10	6,550	..	..

[1] Of these, 215 are employed in the canneries at Seaford.
[2] Of these, 8,864 are employed in the various canneries.
[3] Of these, 1,578 are employed in the canneries.

TABLE SHOWING, by STATES, the PERSONS EMPLOYED, CAPITAL INVESTED, &C.—*continued.*

States.	Apparatus and Capital.				Products.		Enhancement of Value of Oysters in process of preparation for Market.[1]	
	Number of Boats.	Value of Boats.	Value of Gear and Outfit.	Value of Shore Property.	Bushels of Oysters produced.	Value of same to Producer.	Number of Bushels.	Amount of Enhancement.
Total . . .	11,930	$708,330	$712,515	$5,633,750	22,195,370	$9,034,861	13,047,922	$4,368,991
Maine	3	60	150	1,000	..	..	75,000	37,000
New Hampshire .	5	300	100	2,000	1,000	800	7,000	5,250
Massachusetts . .	117	9,485	10,690	56,000	36,000	41,800	514,000	363,750
Rhode Island . .	100	14,500	5,500	90,000	163,200	225,500	274,300	131,425
Connecticut . . .	563	33,165	19,385	239,650	336,450	386,625	515,000	286,250
New York . . .	1,714	121,700	42,460	451,900	1,043,300	1,043,300	1,065,000	533,750
New Jersey . . .	1,400	110,500	91,500	325,000	1,975,000	1,970,000	237,500	110,125
Pennsylvania . .	..	..	..	..	..	..	[4]250,000	137,500
Delaware . . .	300	12,000	10,000	[2]73,500	300,000	325,000	[5]834,500	362,725
Maryland . . .	1,825	130,520	161,480	[3]3,992,350	10,600,000	2,650,000	7,653,492	2,080,476
Virginia	4,481	224,050	329,250	[7]336,850	6,837,320	1,948,636	1,622,130	269,740
North Carolina . .	800	16,000	15,000	15,000	170,000	60,000	..	..
South Carolina . .	100	2,500	2,250	5,000	50,000	20,000	..	..
Georgia	100	10,000	3,500	5,000	70,000	35,000	..	..
Florida	110	8,000	2,000	12,000	78,600	15,950	..	..
Alabama . . .	42	4,000	3,000	3,000	104,500	44,950	..	..
Mississippi . . .	40	1,000	500	1,500	25,000	10,000	..	..
Louisiana . . .	120	3,000	13,000	10,000	295,000	200,000	..	..
Texas	70	6,750	2,000	9,000	95,000	47,300	..	..
Washington Ter. .	40	800	750	5,000	15,000	10,000	..	..

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[1] This includes planting, bedding, fattening, and transportation to distant markets in oyster-vessels.

[2] Of this, 28,500 dollars is invested in the cannery interests at Seaford.

[3] Of this amount, 2,492,350 dollars represents the cash capital invested in the cannery industry.

[4] Brought in winter by vessels registered in other States, the men engaged and the value of the vessels being accounted for elsewhere.

[5] Of these, 184,500 bushels were packed at Seaford, and 650,000 bushels were planted in Delaware Bay.

[6] Of this, 22,225 dollars represents the enhancement on those canned.

[7] Of this, 119,350 dollars represents the cash capital in the cannery interests, and 167,500 dollars the value of buildings and fixtures for canning.

2. *The Pacific Salmon Industry.*—The Salmon fishery of the Pacific is another industry peculiar in its methods and extent. The Quinnat, or King Salmon (*Salmo quinnat*, = *Oncorhynchus chouicha*), also often called the California Salmon, is the principal object of capture, though other related species are also taken. As they ascend in the spring to their spawning beds, they are taken in gill-nets in immense numbers, also in revolving traps of great size and destructiveness. They are for the most part packed in tins, though many are smoked or pickled ; pickled salmon-belly is a favourite delicacy of the region. Though the capture is enormous, it has been demonstrated that the supply can easily be kept up by a small outlay in artificial culture. In 1880, 3370 fishermen, mostly Chinese, took 51,862,000 pounds ; full statistics are given in the appended table. The total value of the product in 1880, was $3,389,934. This industry has sprung into existence for the most part during the past decade.

TABLE SHOWING the NUMBER of SALMON FISHERIES and CANNERIES of the PACIFIC COAST; STATISTICS of FISHERMEN, BOATS, CAPITAL INVESTED in the FISHERIES and FIRST PRODUCTS of the SAME and of CANNERIES; CAPITAL INVESTED in CANNERIES; PRODUCT of the CANNERIES; NUMBER of FACTORY HANDS, with TOTALS of CAPITAL, PERSONS EMPLOYED, and VALUE of PRODUCT for the ENTIRE INDUSTRY.

Regions	Fishermen.	Boats.		Nets.	Value of Boats and Apparatus.	Amount of Catch.		Amount Salted.		
	No.	No.	Value.	Value.		Number of Fish.	Weight in Pounds.	Pounds Fresh.	Pounds Salted.	Value.
Totals	3,370	1,715	$71,800	$71,800	$142,900	2,755,000	51,862,000	1,585,500	1,246,000	$22,600
Sacramento River, California .	500	[1] 330	60,000	60,000	120,000	606,700	10,000,000	528,000	396,000	6,600
Smith and Eel Rivers, California Rogue River, Oregon, and vicinity	110	55	[2] [8,000]	[2] [9,000]	[2] [17,000]	156,000	2,340,000	707,500	570,000	10,400
Columbia River	2,500	1,200	10,000 [2] [232,000]	10,000 [2] [232,000]	20,000 [2] [464,000]	1,925,000	38,500,000	300,000	240,000	4,800
Puget Sound	10	5	800	800	1,600	23,300	350,000	50,000	40,000	800
Alaska	250	125	1,000	300	1,300	44,000	672,000	..	..	..

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[1] Of which 100 are scows.

[2] Capital invested in fishery apparatus by the canneries and included in the aggregate capital of the canneries in a subsequent column.

Regions.	Amount Smoked.		Sold Fresh to San Francisco.		Consumed Locally or Unaccounted for.		Sold to Canneries.			Total to Fishermen.
	Pounds Fresh.	Value.	Pounds.	Value.	Pounds.	Value.	Number of Fish.	Pounds.	Value.	Amount.
Totals	200,000	$5,000	2,000,000	$60,000	4,696,958	$46,969	2,152,509	43,379,542	$909,818	$1,044,387
Sacramento River, California .	200,000	5,000	2,000,000	60,000	1,967,000	19,670	321,548	5,305,000	70,600	170,870
Smith and Eel Rivers, California Rogue River, Oregon, and vicinity	..	..	..	..	40,700	407	106,000	1,591,800	15,918	26,725
Columbia River	..	..	..	..	2,587,258	25,872	1,618,761	35,612,742	809,380	840,052
Puget Sound	..	..	..	..	102,000	1,020	39,000	198,000	1,560	3,380
Alaska	..	..	..	..	..	..	67,200	672,000	3,360	3,360

Regions.	Canneries.		Product of the Canneries.			Enhancement of Value of Salmon in Process of Canning	Factory Hands.	Persons Employed.	Capital.	Value of Product.
	No.	Capital.	Cases.	Pounds in 1-lb. cans.	Value.		Average Number.	Total.	Total.	Total.
Totals	45	$1,239,000	655,274	31,453,152	$3,255,365	$2,345,547	4,940	8,310	$1,381,200	$3,389,934
Sacramento River, California .	10	100,000	80,387	3,858,576	400,935	321,335	800	1,300	220,000	492,205
Smith and Eel Rivers, California Rogue River, Oregon, and vicinity	3	25,000	22,300	1,070,400	111,500	95,582	95	205	25,000	122,307
Columbia River	29	1,100,000	539,587	25,900,175	2,697,930	1,888,550	4,000	6,500	1,120,000	2,728,602
Puget Sound	1	4,000	3,000	144,000	15,000	13,440	15	25	5,600	16,820
Alaska	2	10,000	10,000	480,000	30,000	26,640	30	280	10,600	30,000

The whale fishery has of late years greatly decreased in value, owing to the introduction of mineral oils, and the great diminution in the number of whales, due to over-fishing.

"The entire fleet in 1880 numbered 171 vessels, including 119 bark-rigged vessels, 7 ships, 9 brigs, and 46 schooners. The distribution of the fleet was as follows: Hudson Bay, 5 vessels; North and South Atlantic grounds, 111 vessels; Berring Strait, 25 vessels; Pacific Ocean, 22 vessels; in port throughout the year, 8 vessels.

"The value of the products of the whaling industry in 1880 was $2,636,322; the yield included 37,614 barrels of sperm oil and 34,626 barrels of whale oil, valued at $1,723,808; 458,400 pounds of whalebone, worth 907,049; and $5,465 worth of ambergris and walrus ivory. The Pacific Arctic Ocean grounds were the most productive, yielding oil and bone worth $1,249,990. From the Atlantic Ocean grounds oil and bone were taken worth $908,771.

"Besides the vessel fishery there is a boat or shore-whaling industry at Cape Cod, and in North Carolina, on the coasts of California, Washington Territory and Alaska. The principal species on the Atlantic coast is the finback, and on the Pacific the California gray whale. Humpback, sulphur bottom, and right whales, are occasionally taken in both oceans.

"The whale fishery of this country was in its zenith of prosperity about the middle of the present century, when the fleet numbered 736 vessels, aggregating 231,406 tons, the value being $10,766,521.

"The relative importance of the various whaling grounds," writes Mr. Clark, "during the past years, from 1870 to 1880, is shown by the following facts. Of the sperm-oil landed during that period, 55 per cent. was taken in the North and South Atlantic Oceans, 33 per cent. in the Pacific, and 12 per cent. in the Indian Ocean. Of whale-oil, 58 per cent. came from the North Pacific and the Pacific fleets, 24 per cent. from the North and South Atlantic fleets, 10 per cent. from the South Pacific, 5 per cent. from the Indian Ocean, and 3 per cent. from Hudson Bay, Cumberland Inlet, and Davis Strait. Of the whalebone secured in the same decade, 88 per cent. was from north of the fiftieth parallel in the North Pacific and Arctic Oceans, and 5 per cent. from Hudson Bay and Cumberland Inlet, and the balance from the Atlantic, Indian, and other oceans.

"The number of voyages undertaken by the fleet for 1870 to 1880 was 810, which includes Arctic whalers annually refitting at San Francisco and other ports. Of these voyages 382 were to the North and South Atlantic, 254 to the Pacific, Arctic, and adjacent grounds, 98 to the South Pacific, 45 to the Indian Ocean, and 36 to the Atlantic Arctic grounds, Hudson Bay, Davis Strait, and Cumberland Inlet."

Year.	Ships and Barks.	Brigs.	Schooners.	Total Vessels.	Total Tonnage.
1870 . . .	217	22	77	316	72,173
1871 . . .	214	18	48	280	67,909
1872 . . .	170	12	28	210	51,252
1873 . . .	151	12	28	191	46,230
1874 . . .	129	7	25	161	39,788
1875 . . .	118	8	26	152	36,230
1876 . . .	121	7	30	158	37,182
1877 . . .	120	8	34	162	36,476
1878 . . .	128	11	39	178	39,976
1879 . . .	123	12	42	177	39,391
1880 . . .	126	9	46	181	38,637

Table showing the Value of Sperm-oil, Whale-oil, and Whalebone landed by the American Fleet, the Value of the Consumption in the United States, and the Value of the Exportation annually from 1870 to 1880.

Year.	Landed by the fleet.*	Consumption in the United States.	Exportation.
1870	$4,529,126	$2,896,883	$1,476,864
1871	3,691,469	2,798,408	1,479,153
1872	2,954,783	2,081,468	1,374,098
1873	2,962,106	1,947,037	929,247
1874	2,713,034	2,154,638	1,179,286
1875	3,314,800	1,700,823	1,494,727
1876	2,639,463	1,346,828	1,487,533
1877	2,309,569	1,113,681	924,175
1878	2,232,029	849,043	1,357,162
1879	2,056,069	1,345,582	582,994
1880	2,659,725	1,165,944	795,657

The Menhaden Fishery.—The commercial importance of the Menhaden (*Brevoortia tyrannus*) has but lately come into appreciation. Twenty-five years ago, and before, it was thought to be of very small value. A few millions were taken every year in Massachusetts Bay, Long Island Sound, and the inlets of New Jersey. A small portion of these were used for bait; a few barrels were occasionally salted in Massachusetts, to be exported into the West Indies. Large quantities were ploughed into the soil of the farms along the shores, stimulating the crops for a time, but in the end filling the soil with oil, parching it, and making it unfit for tillage. Since that time manifold uses have been found. As a bait fish this excels all others; for many years much the greatest share of our mackerel was caught by its aid, while the cod and halibut fleet use it rather than any other fish, when it can be procured. The total consumption of Menhaden for bait,

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* From half a million to a million dollars' worth of products are carried over from year to year.

1877, did not fall below 80,000 barrels, or 26,000,000 of fish, valued at $500,000. Ten years before, when the entire mackerel fleet was fishing with hooks, the consumption was much greater. As a food resource it is found to have great possibilities. Many hundreds of barrels are sold in the West Indies, while thousands of barrels are salted down for domestic use by families living near the shore. In many sections they are sold fresh in the market. About 1872 there sprang up an important industry, which consists in packing these fish in oil, after the manner of sardines, for home and foreign consumption. In 1874 the production of canned fish did not fall below 500,000 boxes. This industry has now been discontinued, the herring proving to be better suited for canning. As a source of oil the Menhaden is of more importance than any other marine animal. Its annual yield usually exceeds that of the whale (from the American fisheries) by about 200,000 gallons, and, in 1874, did not fall far short of the aggregate of all the whale, seal, and cod oil made in America. In 1878 the Menhaden Oil and Guano Industry employed capital to the amount of $2,350,000, 3,337 men, 64 steamers, 279 sailing vessels, and consumed 777,000,000 of fish. There were 56 factories, which produced 1,392,644 gallons of oil, valued at $450,000, and 55,154 tons of crude guano, valued at $600,000; this was a poor year. In 1874 the number of gallons produced was 3,373,000; in 1875, 2,681,000; in 1876, 2,992,000; in 1877, 2,427,000. In 1878 the total value of manufactured products was $1,050,000; in 1874 this was $1,809,000; in 1875, $1,582,000; in 1876, $1,671,000; in 1877, $1,608,000; it should be stated that in these reports only four-fifths of the whole number of factories are included. The refuse of the oil factory supplies a material of much value for manures.

As a base for nitrogen it enters largely into the composition of most of the manufactured fertilisers. The amount of nitrogen derived from this source in 1875 was estimated to be equivalent to that contained in 60,000,000 lbs. of Peruvian guano, the gold value of which would not have been far from $1,920,000. The yield of the Menhaden fishery in pounds is probably triple that of any other carried on by the fishermen of the United States. In 1880, with an increased value of products, the Menhaden fishery yielded $2,116,787. In the accompanying table, prepared by Mr. Howard Clark, detailed statistics are given. In estimating the importance of the Menhaden to the United States, it should be borne in mind that its absence from our waters would probably reduce all our other sea fisheries to at least one-fourth their present extent.

The Alaska Fur-Seal and Sea-Otter Industry.—The Seal-fishery has been discussed in Mr. Elliot's monograph recently published by the Census Office. This is in the main situated under the control of the Alaska Commercial Company from the Prybilov Islands of Alaska, where, in accordance with the terms of a lease which they have received from the Government of the United States, they are permitted to kill only 100,000 young males each year, thus securing a permanence of supply. The same company obtained 47,000 skins in addition from the Commander Islands, leased them by Russia. There are also 10,000 skins obtained by the shore fishermen of California, and 56,000 by American fishermen in Puget Sound. The total value of Fur Seal skins obtained by Americans on this coast is placed at $1,540,912.* The skins undergo an immense enhancement of value before leaving the hands of the Alaskan Commercial Company, which has establishments in London where they are plucked and dyed. In the Exhibition may be seen a group of these Seals, and a series of interesting colour sketches by Elliott. According to Mr. Petrov, the yield of Sea-otter skins from Alaska in 1880 amounted to 6000, worth $600,000. In addition to these, 75, valued at $3,750, were taken in California.

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* This estimate is subject to revision.

The Mackerel Fishery.—The Mackerel fishery is one of the most important of the "general fisheries," and is of special interest from having been the chief element of discussion in connection with the Fishery Treaty between Great Britain and the United States, which is soon to come up for readjustment. Prior to 1870 a large fleet of New England vessels resorted to the Gulf of St. Lawrence for Mackerel; in 1882 only one Mackerel-schooner visited Canadian waters, returning with about 200 barrels of fish. This revolution in the Mackerel fishery is due to the introduction of the great purse seine, by which Mackerel are taken by the hundred, or even more, barrels at a time, in the broad ocean between Cape Hatteras and Cape Sable.

This fishery in 1880 employed 468 vessels and 5043 men, and produced 131,939,225 lbs. of fresh fish, of which 117,500,000 lbs., or 343,808 barrels were salted, the remainder being canned or sold fresh.

The Shad and Alewife Fisheries.—Each of our great rivers of the Atlantic coast, the St. Johns, the St. Mary's, the Altamaha, the Savannah, the Ogeechee, the Cape Fear, the Neuse, the York, the James, the Rappahannock, the Potomac, the Patuxent, the Susquehanna, the Delaware, the Hudson, the Housatonic, the Connecticut, the Merrimac, is in the spring or early summer the seat of a fishery of considerable importance, having for its object the capture of the anadromous fishes of the Herring family, which ascend the rivers to spawn at the approach of warm weather.

Seines and drift-nets take them in immense numbers, and for two or three months the entire surrounding country is feasting upon this cheap and luscious food. The product in 1880 was as follows :—

SHAD = *Clupea sapidissima.*

State.	Pounds.	Value.
Maine	580,318	$11,876
Massachusetts	164,524	8,226
Rhode Island	48,100	2,500*
Connecticut.	1,318,032	75,000*
New York	2,733,600	136,680
New Jersey	750,000	35,000
Pennsylvania	559,600	27,980
Delaware	1,050,000	52,500
Maryland	3,759,426	140,326
Virginia	3,171,953	134,496
North Carolina	3,221,263	329,569
South Carolina	207.600	12,432
Georgia	252,000	17,941
Florida	251,700	20,136
	18,068,116	$1,004,462

ALEWIVES = *C. vernalis, &c., aestivalis.*

State.	Pounds.	Value.
Maine	3,249,220	$38,823
New Hampshire	425,000	6,000*
Massachusetts	3,751,000	28,635
Rhode Island	140,000	2,000*
Connecticut	270,000	4,000*
New York	250,000	3,750
New Jersey	1,200,000	17,335
Delaware	1,800,000	26,000
Maryland	9,128,959	139,667
Virginia	6,925,413	76,300
North Carolina	15,520,000	142,784
South Carolina	400,000	9,000
Georgia	125,000	3,750
Florida	10,000	200
	43,194,651	$498,254

* Estimated.

The river fisheries of the southern and middle states are stated by Colonel McDonald to engage 13,017 persons, 78 vessels, and 4815 men; in the north the Shad and Alewife fisheries are chiefly carried on by fishermen engaged in other fisheries at other times in the year.

The Sardine and Herring Fishery.—The Sardine industry of Maine is similar to the Pacific Salmon industry, and of still more recent origin. Up to 1880, according to Mr. R. E. Earll, it was confined to Eastport, and though experiments were made in the preparation of Herrings as Sardines as early as 1866, the business did not practically begin till 1875, since which time it has grown with a remarkable rapidity. In 1880 it furnished employment to over 1,500 fishermen and factory hands, in addition to 376 fishermen belonging to New Brunswick. The capital dependent upon the industry during the same season, including $80,000 belonging to the New Brunswick fishermen, was over $480,000, and the value of the products amounted to nearly $825,000.

"Many of the larger Cape Ann vessels," writes Mr. Earll, "engage in the frozen-herring trade during the winter months, visiting points along the coasts of Maine, New Brunswick, and Newfoundland, where the herring chance to be most abundant, and bringing large trips to the principal New England markets. Formerly they supplied themselves with nets for catching their own fish, and took full crews of fishermen to assist in the work, but of late they find it cheaper to buy fish of the natives, in which case they carry only enough men to work the vessel on the passage. The herring are first frozen on the shore, after which they are thrown, with a little straw, into the hold, and at times even the cabin of the vessel is filled, the crew living in the forecastle. A vessel thus loaded carries from 300,000 to 400,000 fish. About 95 cargoes, worth upwards of $100,000, are bought from the vicinity of Eastport alone; the herrings bought in the British provinces are not included in our statistics.

"In addition to the fish frozen or packed in sardine-cans, herring to the value of $150,000 are smoked, pickled, or sold for bait."

The Clam and Quahaug Fishery.—There are two important kinds of Clams—the Long Clam, or "Maninose," *Mya arenaria*, and the Quahaug, or Round Clam, sometimes called the Wampum Clam, *Venus mercenaria*. Of the former, we are told by Lieut. Winslow:—"Extensive beds occur at intervals along the coast of Maine, and the annual yield is estimated at nearly 316,000 bushels, valued at about $88,472.

"The Massachusetts fishery is the one of most consequence, and the next in point of importance is Narragansett Bay and the Rhode Island shores. While in Massachusetts Bay the profitable season is during the summer months, in Rhode Island the winter's fishing brings in the largest return; a large number of the inhabitants of the shores being engaged during that season in securing soft Clams. The whole coast of Long Island Sound is prolific, and one or two points are especially noted for the abundance, or superior size and quality of the Clams usually found. Guilford, on the Connecticut coast, is especially prominent, the Clams from that vicinity sometimes being 6 and 8 inches long, a pound or more in weight, and retailing in New Haven markets for $1.25 per dozen. These Clams are, however, only obtained at extremely low tides and are comparatively scarce. About 10,000 of the ordinary size are taken per annum, and are sold at from 40 to 60 cents per dozen. All along the southern shore of the sound are prolific clamming grounds, the principal product of the fishery being shipped to New York. The south shore of the island, especially Rockaway Bay, also sends its quota to supply the New York market. New York and Newark Bays formerly supplied large numbers of soft Clams, but of late years those areas have ceased to yield anything of consequence. Along the Jersey coast the annual yield is about 70,000 bushels, valued at about $29,500.

"There is very little in the methods of taking this species that calls for peculiar apparatus or appliances. A spade and bucket are the usual implements at the present day, the use of the plow having been but local, and abandoned when the abundance of the crop decreased. It is still used by Mr. Hawley, but only in cultivating; he having instituted a system of cultivation on a scale of considerable magnitude. His method is, briefly, to plow long furrows in the flats, and lay his Clams in them, some 6 or 12 inches apart. Some five years or more are necessary before the crop is realised, but it then pays exceedingly well.

"While extensively eaten, the larger portion of the annual crop is utilised as bait by the cod and mackerel fishermen.

"The following is a summary of the annual product of the fishery, and its value :—

Total number of Clams (*Mya arenaria*) .	164,195,200
Total number of bushels.	835,974
Value per bushel (average)	$0·395
Total value annual product	$330,523·24

"The 'Quahaug,' or 'Round Clam,' *Venus mercenaria*, (Linnæus,) is found from Florida to Massachusetts Bay, and thence northward, though rare and local, to the Gulf of

Saint Lawrence. It is very common from Vineyard Sound southward.

"The 'Quahaug' fishery is very extensive, this bivalve being, next to the oyster, the most important on the coast; but the implements and methods are simple in the extreme. Many Clams are gathered by hand as they crawl on the flats; many more are taken with straight rakes, curved drag-rakes, and dredges. Oyster-tongs are also occasionally used.

"'Count' Clams, the largest size, bring the best prices, and in the neighbourhood of New York sell for $3 per barrel, wholesale. It takes 800 'counts' to make a barrel; and as 3 to 4 barrels, or 2,400 to 3,200 Clams, is a good day's catch, some idea of the productiveness of the New Jersey flats and coast is gained from the foregoing. Smaller sizes are sold at 60 cents or $1 per bushel, depending on the size, and some are taken so small that 2,000 are required to fill a barrel; these, when about one inch in diameter, are called 'tea-clams.' Another name is 'Little Neck,' derived originally from a neck of land on the north shore of Long Island, known as Little Neck, whose Clams had a superior flavour; but the demand for a young, small, and tender Clam which has sprung up of late years, and was supplied from the Little Neck stock, has caused dealers generally to apply the term 'Little Neck' to all small Clams. They are used principally for pickling.

"The fishery is not an expensive one, the whole outfit of the 'clammer' not requiring an expenditure of over $150, including boat, rake, and baskets, and the pursuit is naturally followed by the poorer class of people—men who are employed by the oyster-dealers in winter and are out of work during the summer. The principal depôts are New York and Philadelphia, but a large number of Clams are consumed throughout the interior of the New England and Middle States, and every sea-board town sends its quota to supply the demand. To the southward of the Delaware and Chesapeake this consumption diminishes very fast, that of all the Southern States being estimated by Ingersoll at not more than 50,000 bushels, valued at $20,000.

The summary of the annual product and value of the "Quahaug" fish-fishery for the whole coast is:—

Number of Clams taken	326,245,800
Number of bushels	1,087,486
Value	$657,747

The Lobster Fishery.—"The Lobster fishery," writes Richard Rathbun, "began on the Massachusetts coast about the beginning of the present century, and on the Maine coast about 1840. It has rapidly developed to the present time. At first, Lobsters were frequently found near low-water mark. They rarely occur in such situations now, and the fishery is mainly carried on in depths of a few fathoms to twenty or thirty fathoms; but sometimes in depths of forty to sixty fathoms.

"The Lobster fishery is regularly carried on by means of wooden framework traps, or pots, generally constructed of common house-laths, baited with cheap or refuse fish, weighted with stones, and lowered and raised by means of a rope. The number of pots used by each fisherman varies in different localities, ranging all the way from eight or ten, to one hundred. The average number may be said to be about fifty or sixty. The pots are set either singly or attached together in trawls, the character of the bottom, abundance of lobsters, and custom, regulating this matter. When set trawl-fashion, the pots are fastened together in strings of ten or a dozen, to fifty or sixty, at distances apart of fifteen to twenty fathoms, and have a long buoy line at each end.

"The principal Lobster markets of the country are Portland, Boston, and New York. Lobsters are in season during the entire year; but are much more abundant in the markets, and much more highly prized as food during the late spring, summer, and early fall.

"The canning of Lobsters in the United States is entirely confined to the coast of Maine; and most of the provincial canneries are controlled by American capital. Without its canning interests, the Maine Lobster fishery would lose much of its prestige, as the majority of the Lobsters canned are below the regulation size established by custom for the fresh markets. The market-smacks will seldom buy Lobsters measuring less than ten or ten and a half inches in length, and those under this size are sold to the canneries. The canning industry was first started about 1840, at Eastport, Maine; but several years elapsed before it was successfully introduced. In 1880, there were twenty-three canneries in Maine, with a total capital of $289,000, remaining open from about April 1 to August 1, and giving employment to about 650 factory hands and 2,000 fishermen. The quantity of fresh Lobsters used, amounted to about 9,500,000 pounds, valued at $95,000 to the fishermen. The value of the canned products was $238,000, an enhancement in value by the process of canning of $143,000. Seventeen provincial canneries are owned by Americans, as follows:—one each in Newfoundland, the Magdalen Islands, and Prince Edward Island, three in New Brunswick, and eleven in Nova Scotia. The total amount of capital invested in 1880, was $213,000; 10,000,000 pounds of fresh Lobsters were consumed that year, and the value of the canned products was $246,000. These products are all exported to Europe and other foreign countries, none passing into the United States.

"The total catch of Lobsters on the Maine coast in 1880, amounted to 14,234,000 pounds, valued at $268,000, first cost, or fishermen's prices. The catch for Massachusetts was 4,315,000 pounds, valued at $158,000, and that of the entire coast of the several Lobster states, was 20,128,000 pounds, worth $483,000, first price. The quantity of Lobsters handled by the several large fresh markets during 1880 was as follows: Portland, 2,000,000 pounds; Boston, 3,637,000 pounds; New York, 2,500,000 pounds; a total of 8,137,000 pounds. The enhancement in value of these Lobsters in passing through the large markets was $105,000, making the total value of the Lobster products, as they entered the hands of the smaller wholesale and the retail dealers, $732,000."

The Halibut Fishery.—There are several special fisheries of great interest carried on from certain parts of New England. The Halibut fishery is peculiar to Gloucester. The fresh Halibut fishery employs, winter and summer, a fleet of about thirty of the staunchest and swiftest schooners of eighty to one hundred tons, manned by crews of men whose seamanship and daring cannot be surpassed. The fishery is extremely perilous, being prosecuted on the outer banks in water from 1,200 to 1,800 feet in depth. Voyages continue three to seven weeks. The fish are brought to market in ice, and distributed almost over the entire continent.

The so-called salt Halibut fishery is prosecuted by a number of Gloucester fishery-factors, who send every summer a number of schooners to the Grand Bank of Newfoundland, and often a few into Davis' Straits. These vessels salt down in their holds the Halibut which they obtain, and on their return it is smoked, producing smoked Halibut of the choicest kind—the so-called "bank-halibut."

The Crab Fishery.—"Over twenty species of Crabs belonging to the coasts of the United States are now regarded," writes Rathbun, "as of greater or less practical importance to mankind. The most valuable of these are the Blue Crab (*Callinectes hastatus*), Lady Crab (*Platyonichus ocellatus*), Stone Crab (*Menippe mercenarius*), and Rock Crabs (*Cancer irroratus* and *C. borealis*), of the east coast, and the Common Crab, Rock Crab, and Red Crab (*Cancer magister*, *C. antennarius*, and *C. productus*), of the Pacific Coast. The remaining species are utilized simply as bait, or to a slight extent only as food.

"The Blue Crab is the common edible Crab of the Atlantic Coast, and ranges from Massachusetts Bay to the Gulf of Mexico. The season for its fishery is of variable duration on different parts of the coast. At New York it lasts from May to October, while in Florida it begins as early as March and continues until December, or, if the weather be mild, through the entire winter. This Crab is eaten in both the hard and soft shell condition, but is greatly preferred, and commands a much higher price, when in the latter state. Soft-shell Crabs are, however, seldom taken in marketable quantities excepting on the New Jersey coast, whence New York derives the greater part of its supplies. The Crab fishery for New Jersey alone amounted to over $160,000, in 1880.

"Several different appliances are used in the capture of Blue Crabs, the most common being the ordinary scoop or dip net, also called crab-net. For attracting the Crabs from depths not easily reached by means of the dip-net, the fishermen resort to baited lines, without hooks, which are used singly or made up into trawls 250 to 700 feet in length. Seines, hoop-nets, baited with meat, and clam-tongs are also occasionally employed for catching Crabs. As the Soft Crabs remain in a semidormant condition, and will not take the bait, they are secured almost entirely by means of scoop-nets from the beaches, or in the hands. Floating cars are extensively employed in some localities, for keeping the Hard Crabs until they shall have cast their shells and become soft. Crabs are generally shipped to market in boxes, baskets, or barrels, with or without packing. Small boxes are mainly preferred for the Soft Crabs, which are packed in very snugly in order that they may stand transportation without injury, and so that the moisture will not run too freely from the gills. The Crab catchers consist largely of women and children, especially in the Southern States.

"In 1880, there were three Crab canneries in the United States, two being located at Hampton, Virginia, and one at Oxford, Maryland.

"The Crab fisheries of the eastern coast of the United States, in 1880, amounted to $328,000 (fishermen's prices), of which the greater part belonged to New York, New Jersey, Delaware, Maryland, and Virginia. South of Virginia, on the Atlantic coast, the Crab fishery is of but slight importance at present; on the Gulf coast it amounts to about $10,000 annually, and is mainly confined to Louisiana."

The Winter Haddock Fishery.—The winter Haddock fishery of Gloucester is almost as perilous as the winter Halibut fishery. In it were employed, in 1880, seventy-seven of the best vessels engaged in summer in the cod and mackerel fisheries. About 45,000,000 Haddocks are annually caught on the New England coast.

The Sponge Fishery.—The American Sponge fishery is now a well-established industry of considerable importance, and gives employment to a large fishing fleet. Professor Alpheus Hyatt, one of the most recent writers on American Sponges, regards most of the American commercial forms as identical specifically with the Mediterranean, but separates them on subspecific differences. The same subspecies belong to both Florida and the Bahama Islands, but fewer commercial grades are recognised from the former than from the latter region. The finest quality of American Sponge is the Sheepswool, which now commands a higher price than those from the Bahamas. I quote again from Mr. Rathbun:

"The Florida Sponge grounds form three separate elongate stretches, along the southern and western coasts of the state. The first includes nearly all of the Florida Keys; the second extends from Anclote Keys to Cedar Keys; and the third from just north of Cedar Keys to Saint Mark's, in Apalachee Bay. The linear extent of these grounds is about 120 miles, and their breadth varies from a few miles to 15 or 20 miles. The total area of the Sponge grounds worked in 1880 was reckoned at about 3,000 square geographical miles, but this does not by any means cover the possibilities of the coast, as many additional sponging areas have been discovered since then. Key West is the principal headquarters for the Sponge fleet. The Florida Sponge fishery differs from the Mediterranean in that no divers are employed. The Sponge fleet consists of over 100 vessels, ranging in size from 5 to 50 tons burden.

"The cruises last from four to eight weeks, at the end of which time the vessels return to Key West, a few only going to Apalachicola. The process of bleaching or liming

Sponges has been extensively in vogue at Key West, but it is now meeting with much discouragement from the trade, for while it renders the Sponge much lighter in colour, it also partly destroys its fibre, and makes it less tough and durable. The Florida Sponges are all shipped from Key West and Apalachicola to New York. The value of the Florida Sponge fishery to the fishermen averages about $200,000 annually.

"The Florida Sponge fishery originated about 1852, for, although the occurrence of Sponges on the Florida reefs was previously made known, the species were not supposed to be of commercial value. The industry has gradually developed to the present time, but during the past few years has remained at about the same standing. The demand for the better grades greatly exceeds the supply. Fully 75 per cent. in value of all the Florida Sponges marketed are of the Sheepswool variety."

The Swordfish Fishery.—The Swordfish fishery is carried on from New Bedford, New London, and several smaller ports of southern New England. About 15 small vessels are employed in summer, and the yield of their harpoons, together with that from the mackerel vessels, amounts to about 1,500,000 pounds.

VII.

I have been asked to describe somewhat fully the aims, methods and achievements of the United States Fish Commission.

On the 9th of February, 1871, Congress passed a joint resolution which authorized the appointment of a Commissioner of Fish and Fisheries. The duties of the Commissioner were thus defined: "To prosecute investigations on the subject (of the diminution of valuable fishes) with the view of ascertaining whether any and what diminution in the number of the food-fishes of the coast and the lakes of the United States has taken place; and, if so, to what causes the same is due; and also whether any and what protection, prohibitory or precautionary measures should be adopted in the premises, and to report upon the same to Congress."

The resolution establishing the office of Commissioner of Fisheries required that the person to be appointed should be a civil officer of the Government, of proved scientific and practical acquaintance with the fishes of the coast, to serve without additional salary. The choice was thus practically limited to a single man for whom, in fact, the office had been created. Professor Spencer F. Baird was appointed and entered at once upon his duties.

I think I may say without fear of challenge that very much of the improvement in the condition of our fisheries has been due to the wise and energetic management of our Commissioner. Himself an eminent man of science, for forty years in the front rank of biological investigation, the author of several hundred scientific memoirs, no one could realise more thoroughly the importance of a scientific foundation for the proposed work.

His position as the head of that most influential scientific organisation, the Smithsonian Institution, given by an Englishman to the United States "for the increase and diffusion of useful knowledge among men," enabled him to secure at once the aid of a body of trained specialists.

Pure and applied science have laboured together always in the service of the Fish Commission, their representatives working side by side in the same laboratories; indeed, much of the best work both in the investigation of the fisheries and in the artificial culture of fishes has been performed by men eminent as zoologists.

The principal activity of the Commissioner, however, has been directed to the wholesale replenishment of our depleted waters. The success of fish culture is well recognised in the United States, but it was especially gratifying to its advocates that in 1880 the Grand Prize of the International Fisheries Exhibition at Berlin was awarded to Professor Baird as "the first fish-culturist in the world."

The work of the Commission is naturally divided into three sections:—

1. The systematic investigation of the waters of the United States and the biological and physical problems which they present. The scientific studies of the Commission are based upon a liberal and philosophical interpretation of the law. In making his original plans the Commissioner insisted that to study only the food-fishes would be of little importance, and that useful conclusions must needs rest upon a broad foundation of investigations purely scientific in character. The life history of species of economic value should be understood from beginning to end, but no less requisite is it to know the histories of the animals and plants upon which they feed or upon which their food is nourished; the histories of their enemies and friends, and the friends and foes of their enemies and friends as well as the currents, temperatures and other physical phenomena of the waters in relation to migration, reproduction and growth. A necessary accompaniment to this division is the amassing of material for research to be stored in the National and other museums for future use.

2. The investigation of the methods of fisheries, past and present, and the statistics of production and commerce of

fishery products. Man being one of the chief destroyers of fish, his influence upon their abundance must be studied. Fishery methods and apparatus must be examined and compared with those of other lands, that the use of those which threaten the destruction of useful fishes may be discouraged, and that those which are inefficient may be replaced by others more serviceable. Statistics of industry and trade must be secured for the use of Congress in making treaties or imposing tariffs, to show to producers the best markets, and to consumers where and with what their needs may be supplied.

3. The introduction and multiplication of useful food fishes throughout the country, especially in waters under the jurisdiction of the general government, or those common to several states, none of which might feel willing to make expenditures for the benefit of the others. This work, which was not contemplated when the Commission was established, was first undertaken at the instance of the American Fish Cultural Association, whose representatives induced Congress to make a special appropriation for the purpose. This appropriation has since been renewed every year on an increasingly bountiful scale, and the propagation of fish is at present by far the most extensive branch of the work of the Commission, both in respect to number of men employed and quantity of money expended.

VIII.

The origin of the Commission, its purposes, and methods of organization, having been described, it now remains to review the accomplished results of its work. In many departments, especially that of direct research, most efficient services have been rendered by volunteers; in fact, a large share of what has been accomplished in biological and physical exploration is the result of unpaid labour on the part of some of the most skilful American specialists. Although I should be glad to review the peculiar features of the work of each investigator, the limits of this paper will not allow me even to mention them by name.

Since the important sea fisheries are located along the North Atlantic, the coast of this district has been the seat of the most active operations in marine research. For twelve years the Commissioner, with a party of specialists, has devoted the summer season to work at the shore, at various stations along the coast, from North Carolina to Nova Scotia.

A suitable place having been selected, a temporary laboratory is fitted up with the necessary appliances for collection and study. In this are placed from ten to twenty tables, each occupied by an investigator, either an officer of the Commission or a volunteer.

The regular routine of operations at a summer station includes all the various forms of activity known to naturalists—collecting along the shore, seining upon the beaches, setting traps for animals not otherwise to be obtained, and scraping with dredge and trawl the bottom of the sea, at depths as great as can be reached by a steamer in a trip of three days. In the laboratory are carried on the usual structural and systematic studies; the preparation of museum specimens and of reports.

The permanent head-quarters are located at Wood's Holl, Massachusetts, where wharves are being built for the accommodation of the fleet of the Commission, and a house for use as scientific and fish-cultural laboratories, and where the propagation of sea-fishes will be continued on a larger scale than heretofore.

In addition to what has been done at the summer station, more or less exhaustive investigations have been carried on by smaller parties in every important position of the coast and interior waters.

For several years steamers were lent for the work by the Secretary of the Navy and the Coast Survey and Revenue Services.

In 1880, however, a steamer of 450 tons, the *Fish Hawk*, was built for the Commission. This being needed for fish-hatching purposes, another larger steamer, of 1000 tons, the *Albatross*, has just been built and put into commission. She has already, since April, made two successful deep-sea explorations, and has been supplied with every means for work of this kind.

The general practical results of this part of the work cannot be satisfactorily summed up on account of the number of important investigations still in progress.

One of the important features of the work has been the preparation of life histories of the principal fishes, great quantities of material having been accumulated relating to almost every species. A portion of this has been published, biographical monographs having been published on the bluefish, the scup, the menhaden, the salmon, the whitefish, the shad, the mackerel, the swordfish; and others are being printed.

Similar monographs upon the lobster, oyster, and other invertebrates are also ready.

In connection with the work of fish culture much attention has been paid to embryology. The breeding times and habits of nearly all of our fishes have been studied, and their relations to water temperatures. The embryological history of a number of species, such as the cod, shad, alewife, salmon, smelt, Spanish mackerel, striped bass, white perch, the silver gars, the clam and the oyster, have been obtained under the auspices of the Commission.

Many other problems have been worked out by specialists for the Commission, the details of which are described in the reports. One of these, for instance, has been the determination of the cause of the reddening of salt codfish, so injurious to commerce. Prof. Farlow found this to be due to the presence of a species of alga in the kind of salt in common use, and gave instructions by which the plague has been greatly lessened.

An investigation into the chemical composition and nutritive value of fish as compared with other food is still in progress, and all American food fishes are being analysed by Professor Atwater.

The temperature of the water, in its relation to the movements of fish, has from the first received special attention. Observations are made regularly during the summer work, and at the various hatching stations. At the instance of the Commissioner, an extensive series of observations have for several years been made under the direction of the chief signal officer of the army, at lighthouses, lightships, life-saving and signal stations, carefully chosen, along the whole coast. A number of fishing schooners and steamers have kept similar records. One practical result of the study of these observations has been the demonstration of the cause of the failure of the menhaden fisheries on the coast of Maine in 1879—a failure on account of which nearly 2000 persons were thrown out of employment.

A most remarkable series of contributions have been received from the fishermen of Cape Ann. When the Fish Commission had its head-quarters at Gloucester, in 1878, a general interest in the zoological work sprang up among the crews of the fishing vessels, and since that time they have been vying with each other in efforts to find new animals. Their activity has been stimulated by the publication of lists of their donations in the local papers; and the number of separate lots of specimens received, to the present time, exceeds eight hundred. Many of these lots are large, consisting of collecting-tanks full of alcoholic specimens. At least thirty fishing vessels were carrying collecting-tanks on every trip, until it became necessary to recal them because no more specimens were required, and many of the fishermen, with characteristic superstition, had the idea that it ensured good luck to have a tank on board, and would not go to sea without one. The number of specimens acquired in this manner is at least 50,000 or 60,000, most of them belonging to species unattainable. Each halibut vessel sets, once or twice daily, lines from ten to fourteen miles in length, with hooks upon them fifteen feet apart, in water 1200 to 1800 feet in depth, and the quantity of living forms brought up in this manner, and which had never hitherto been saved, is very astonishing. Over thirty species of fishes have thus been added to the fauna of North America, and Professor Verrill informs me that the number of new and extra limital forms thus placed upon the list of invertebrates cannot be less than fifty.

The investigation of the statistics and history of the fisheries has perhaps assumed greater proportions than was at first contemplated. One of the immediate causes of the establishment of the Commission was the dissension between the line and net fishermen of Southern New England with reference to laws for the protection of the deteriorating fisheries of that region. The first work of Prof. Baird, as Commissioner, was to investigate the causes of this deterioration.

Each year increasing attention has been paid to this subject. The Commissioner has never advised any legislation on the part of the general government, each state government having control over the fisheries in its own waters. Certain general conclusions concerning the effect of the fisheries upon the abundance of aquatic animals, seems to meet with general acceptance in the United States.

The important distinction between *the extermination of a species*, even in a restricted locality, and *the destruction of a fishery*, should be noticed. The former is somewhat unusual, and seemingly impossible in the case of oceanic species, while the latter, especially for limited regions, is almost of yearly occurrence.

1. Aquatic mammals like seals may be entirely exterminated, especially when, like the fur-seals, they forsake the water and occupy the land for breeding purposes. The fur-seals of our Pacific coast are nearly gone, except upon the Prybilov Islands of Alaska, where they are protected by the general government, the islands being leased to a company, who are allowed to kill only 100,000 each year, these being non-breeding males, and the permanence of this fishery thus being perfectly secured.

2. Aquatic mammals which do not leave the water, such as whales and manatees, conspicuous on account of their size, and not capable of rapid multiplication, may be practically exterminated when they breed near the shore. As examples, may be cited the cases of the Arctic sea-cow of the North Pacific, *Rhytina Stelleri*, and the Pacific gray-whale, or devil-fish, *Rhachianectes glaucus*, the tale of whose destruction in the lagoons of California may be found in Scammon's 'Marine Mammals of the Pacific Coast.'

3. In the case of fixed animals like the sponge, the

mussel, the clam, and the oyster, the colonies or beds may be practically exterminated, exactly as a forest may be cut down. The destruction of the oyster-beds of Pocomoke Sound, in Maryland, a large estuary, formerly very productive, is an example—the destruction being due more directly to the choking of the beds by the rubbish raked over them by the dredges, and the destruction of the ledges suitable for the reception of the young spat, than to the removal of all the adult oysters, which was, of course, never effected.

The preservation of the oyster-beds is a matter of vital importance to the United States, for oyster-fishing, unsupported by oyster-culture, will, within a short period, destroy the employment of tens of thousands and the cheap and favourite food of tens of millions of our people.

Something may be effected by laws which allow each bed to rest for a period of years after each season of fishing upon it. It is the general belief, however, that shell-fish-beds must be cultivated as carefully as garden-beds, and that this can only be done by leasing them to individuals. This is already the practice in the Northern States, where oysters are planted in new localities; there is difficulty however, in carrying out this policy in the case of natural beds, to which the fishermen have had continued access for centuries. It is probable that the present unregulated methods will prevail until the dredging of the natural beds come to be remunerative, and that the oyster industry will then be transferred from the improvident fishermen to the care-taking oyster-culturists, with a corresponding increase in price and decrease in consumption.

4. Fishes in ponds, lakes or streams are quickly exterminated unless the young fish are protected, the spawning season is undisturbed, and wholesale methods of capture

are prohibited. Many of our older states now have excellent laws for the preservation of game and fish, which are enforced, not by fishery wardens, but by the agency of societies and anglers' clubs, whose members are expected to prosecute offenders against the public interest.

5. A river may quickly be emptied of its anadromous fishes, salmon, shad, and alewives, by over-fishing in the spawning-season, as well as by dams which cut off the fish from their spawning-grounds. Examples of this may be found in dozens of American rivers.

In the same way, sea-fishes approaching the coasts to spawn upon the shoals or in the bays may be embarrassed, and the numbers of each school decimated, particularly if, as in the case of the herring, the eggs are adhesive and heavy.

Sea fishes spawning in the estuaries are affected by wholesale capture with stake nets, much in the same manner, though in a less degree, than salmon in the rivers. An example is apparently found in the temporary depression in the scuppaug or porgy fishery of Narragansett Bay.

Our shad and alewife fisheries are protected by an economic code of laws, different in the different states, and in the different rivers of each state. The most satisfactory laws are those which regulate the dates at which fishing must begin and close, and prescribe at least one day in the week, usually Sunday, in which the ascent of the fish must not be interrupted.

Massachusetts regulates its stake-net fisheries along the coast in a similar manner.

Migratory, semi-migratory, or wandering fishes, ranging in schools or singly over broad stretches of ocean, mackerel, herring, menhaden, blue-fish, bonito or squeteague, are apparently beyond the influence of human agency, especially since they spawn at a distance from the coast, or since the adults, when about to spawn, cannot be reached by any kind of fishery apparatus. Their fecundity is beyond comprehension, and in many instances their eggs float free near the surface, and are quickly disseminated over broad areas. The conclusions gained by Professor Baird tally exactly with those of Professor Huxley, that the number of any one kind of oceanic fish killed by man is perfectly insignificant when compared with the destruction effected by their natural enemies.

Their movements are no more to be anticipated than those of the atmosphere; and in many instances, with no intelligible cause, some of the most abundant species, the blue-fish, the chub-mackerel, the little tunny, the scuppang, and the bonito, have absented themselves for considerable periods of years.

The chart showing the history of the mackerel fishery for the past eighty years, hanging in the American court, is an illustration of this statement. The variations in abundance cannot be explained by any facts in our possession; and the yield in 1882 was greater than ever before, notwithstanding the fact that the fisheries of the past ten years have been prosecuted with unusual vigour. The remarkable change in the habitat of the menhaden, occurring in 1880, and promising to be permanent, was certainly not the effect of over-fishing, though fifteen years ago it would have been regarded as such. When the production of a region falls in two successive summers from 617,000 to 550 barrels, it is evident that nature, not man, is the cause.

The variations in the abundance of cod and haddock along the coast and on the banks within the last half century have been equally inexplicable.

Almost any piece of water, be it a bay or sound, or be it the covering of a ledge or shoal at sea, may be over-fished to such a degree that fishing becomes unprofitable, especially if fishing be carried on in the spawning season. This statement refers, of course, only to the fishes which feed near the bottom. A familiar example is the abandonment of Massachusetts Bay by the halibut, and the extension of the fishery into very deep water.

Protection to the local fishermen may therefore require the regulation by law of definite fishing-grounds near the coast. There can be no doubt that the extensive fisheries prosecuted by menhaden steamers in the Gulf of Maine were prejudicial to the shore fishermen by driving the fish they formerly caught for bait out to sea and beyond the reach of their nets. There is also reason to believe that our great purse-seine fisheries for menhaden and mackerel, though perhaps not causing a decrease in the numbers of the fish, have kept them farther from the shore. There is a decided disposition on the part of the most intelligent men engaged in these fisheries to press the passage of a law which should prevent the use of the purse-seine before the first of June.

It has been stated that no legislative action has ever been recommended by the Commissioner of Fisheries. The statutes of the various states contain numerous laws for the protection of fish and fishermen, generally worse than useless, though there are many definitions of close time, which appear to be beneficial. To enforce these laws would, however, render necessary a large force of fish-wardens.

The policy of the United States Commissioner has been to carry out the idea that it is better to expend a small amount of public money in making fish so abundant that they can be caught without restriction and serve as cheap food for the people at large, rather than to expend a much larger amount in preventing the people from catching the few that still remain after generations of improvidence.

The proper function of *public fish culture* is the stocking of the public waters with fish in which no individual can claim the right of property. This is being done in our rivers, with salmon, shad, and alewives, and in our lakes with whitefish.

Public fish culture is only useful when conducted upon a gigantic scale—its statistical tables must be footed up in tens of millions. To count young fish by the thousand is the task of the private propagator.

The use of steamships and steam machinery; the construction of refrigerating transportation cars, two of which, with a corps of trained experts, are constantly employed by the Commissioners, moving fish and eggs from Maine to Texas, and from Maryland to California, and the maintenance of permanent hatching stations, 17 in number, in different parts of the continent, are forms of activity only attainable by government aid.

Equally unattainable by private effort would be the enormous experiments in transplanting and acclimatising fish in new waters; California salmon in the rivers of the east; land-locked salmon and smelt in the lakes of the interior; such as the planting of shad in California and the Mississippi Valley; and German carp in ten thousand separate bodies of water in almost every state in the union: the two last-named experiments, carried out within a period of three years, is a success beyond doubt, and of the greatest importance to the country; the others have been more or less successful, though their results are not yet fully realised.

It has been demonstrated, however, beyond possibility of challenge, that our great river fisheries, producing in 1880, 48,000,000 pounds of alewives, 18,000,000 pounds of shad, 52,000,000 pounds of salmon, besides bass, sturgeon, and smelt, and worth "at first hands," between 4,000,000 and 6,000,000 of dollars, are entirely under the control of the fish culturist to sustain or to destroy, and capable of immense extension.

The same is true of the *Coregonus* fisheries of the Great Lakes, and there is every reason to believe, from experiments in part completed, that the dominion of fish culture may be extended in like manner for certain of the great sea productions, such as the cod, haddock, herring, mackerel, and Spanish mackerel fisheries.

The immense influence upon the sea fisheries of the maintenance of the abundance of anadromous fish in the rivers has already been indicated.

I am indebted to Mr. Earll for the following statistics of the work of the United States Commission:—

"As the operations of the Commission have increased, and the propagation of additional species has been undertaken, it has been found desirable to increase the number of hatching stations. These are of two kinds, known as collecting and distributing stations. The former are located near the spawning grounds of those species for which they are especially intended. The eggs are secured at these stations, and enough having been reserved to stock the waters of that region, the remainder are sent to distributing stations, usually located at some central point, to be hatched and shipped to the waters for which they are intended."

The following is a list of the hatching-stations operated by the United States Fish Commission in 1883:—

1. Grand Lake Stream, Maine, station for collecting

eggs of the Schoodic salmon (*Salmo salar* var. *sebago*).

2. Bucksport, Me., station for collecting and hatching eggs of the Atlantic salmon (*Salmo salar*), and for hatching eggs of white-fish (*Coregonus clupeiformis*) to be distributed in the waters of the State.
3. Wood's Holl, Mass. Permanent coast-station, which serves as a base of operations for the scientific investigations of the Commission, and as a hatching station for eggs of the cod (*Gadus morrhua*) and other sea-fishes.
4. Cold Springs Harbour, Long Island, New York. Station for hatching eggs of various species of salmonidæ for distribution in New York and vicinity.
5. Havre de Grace, Maryland. Station located on Battery Island, in the Susquehanna River, for the purpose of collecting and hatching eggs of the shad (*Clupea sapidissima*).
6. Washington, District of Columbia.
    - *a.* National Carp ponds. Ponds for the propagation of the three varieties of the carp (*Cyprinus carpio*), and the goldfish (*Carassius auratus*), the golden ide (*Idus melanotus* var. *auratus*), and the tench (*Tinca vulgaris*).
    - *b.* Arsenal ponds. Ponds for the propagation of carp (*Cyprinus carpio*).
    - *c.* Navy Yard. Station for collecting and hatching eggs of the shad (*Clupea sapidissima*).
    - *d.* Central hatching station. A station fully equipped for scientific experiments connected with the propagation of fishes. The station is also provided with apparatus for hatching

the eggs of all of the more important species, including light, heavy, and adhesive eggs. It is the principal distributing station of the Fish Commission, for both eggs and young fish, to all portions of the United States.

7. Wytheville, Virginia. A station for hatching eggs of brook-trout (*Salvelinus fontinalis*) and California trout (*Salmo irideus*).
8. Saint Jerome's Creek, Point Lookout, Maryland. A station for the artificial propagation of the oyster (*Ostrea virginiana*), the Spanish mackerel (*Scomberomorus maculatus*), and the bandy porgy (*Chætodipterus faber*).
9. Avoca, North Carolina. A station on Albemarle Sound, at the junction of Roanoke and Chowan Rivers, for collecting, hatching, and distributing eggs of the shad (*Clupea sapidissima*), alewife (*Clupea vernalis* and *æstivalis*), and striped bass (*Roccus saxatilis*).
10. Northville, Michigan. A hatching station for the development and distribution of eggs of the white-fish (*Coregonus clupeiformis*). This station is also provided with tanks and ponds for the spawning, hatching, and rearing of brook-trout (*Salvelinus fontinalis*) and California trout (*Salmo irideus*).
11. Alpena, Michigan. A station for the collection and development of the eggs of the white-fish (*Coregonus clupeiformis*).
12. Baird, California.
    - *a.* Salmon station. A station on the McCloud River for the development and distribution of eggs of the California salmon (*Oncorhynchus chouicha*).

b. Trout ponds. A station near Baird, for collecting, developing, and distributing eggs of the California trout (*Salmo irideus*).

13. Clackamas River, Oregon. A station on Columbia River for collecting and hatching eggs of the California salmon (*Oncorhynchus chouicha*).

"It is impossible from the data at hand to give detailed statistics of the work done at all of the stations above mentioned; a statement of the operations of three or four of the larger ones must therefore suffice.

"The hatchery at Northville, Michigan, under the direction of Mr. Frank N. Clark, passed into the hands of the United States Fish Commission in 1880, and is now one of the most important stations for salmonidæ in the world. It is provided with natural and artificial ponds in which brook-trout, rainbow-trout, land-locked salmon and lake-trout, are kept for breeding purposes. In addition to the eggs obtained from these ponds, many millions of eggs of the white-fish, lake-trout, and wall-eyed pike are obtained in the waters of Lake Erie, and forwarded to Northville to be hatched and distributed. During the season of 1882-3, 70,950,000 eggs of the salmonidæ were handled at this hatchery, a large percentage of which were hatched and distributed to different waters. A large refrigerator is being put in in readiness for next season's work, when it is expected that fully 500,000,000 eggs of the white-fish alone will be hatched.

"The hatcheries at Bucksport and Grand Lake Stream are both under the superintendence of Mr. Charles G. Atkins. The former of these is provided with ponds in which salmon, purchased from the fishermen of the Penobscot River, in May, are confined till November, at which time the eggs are taken and the fish liberated. At Grand Lake Stream, where the land-locked salmon is hatched, the eggs are obtained from the native fish which, when attempting to ascend to their natural spawning grounds, are turned aside into enclosures of netting, where they are retained until all of the eggs have been secured. There were secured at these two stations, during the past season, 3,675,000 eggs of these species for distribution to different parts of the United States.

"The hatchery on the McCloud River in California was established in 1872, under the superintendence of Mr. Livingston Stone, who has secured large quantities of eggs of the California salmon annually. The eggs have been taken from the wild salmon, which have been prevented from ascending to their natural spawning grounds by a dam which he has caused to be thrown across the river just above the hatchery. Eggs of the rainbow-trout also have been secured in considerable numbers.

"Owing to the lateness of the appropriation, little was done at the hatchery last year, only 4,000,000 salmon and 337,500 trout-eggs being secured. Most of these were hatched and planted in the waters of the Sacramento River. Mr. Stone gives the following comprehensive statement of the work accomplished since the establishment of the hatchery.

"In the eleven years since the salmon-breeding station has been in operation, 67,000,000 eggs have been taken, most of which have been distributed in the various States of the Union. Several million, however, have been sent to foreign countries, including Germany, France, Great Britain, Denmark, Russia, Belgium, Holland, Canada, New Zealand, Australia, and the Sandwich Islands.

"About 15,000,000 have been hatched at the station, and the young fish placed in the McCloud and other tributaries of the Sacramento River. So great have been the benefits of this restocking of the Sacramento that the statistics of the salmon fisheries on the Sacramento show that the annual salmon catch of the river has increased 5,000,000 pounds during the last few years.

"The shad stations at Washington, D. C., and Havre De Grace, Maryland, have been recently enlarged, and are now capable of holding immense numbers of eggs. At one of the Washington stations alone nearly 50,000,000 of eggs were received. An estimate of those for the other stations gives a total of over 70,000,000 eggs of this species.

"In 1877 the German carp was introduced into America by the United States Fish Commission. These were placed in ponds, especially prepared for them, at Washington and Baltimore. In 1880 the distribution of fry began, and up to January 1st of this year, the carp have been planted in no less than 17,860 localities. They prove to be especially adapted to our waters, and in some localities they grow with surprising rapidity. A fish, 4 inches long, placed in the waters of Texas, was found to have increased to 20½ inches in eleven months, at which time it weighed 4 pounds 11 ounces."

The propagation work has increased in importance from year to year, as may be seen by the constant increase in the amount of the annual appropriation. A review of the results of the labours of the Commission, in increasing the food supply of the country, may be found in the annual reports; the rude appliances of fish culture in use ten years ago have given way to scientifically devised apparatus, by which millions of eggs are hatched where thousands were, and the demonstration of the possibility of stocking rivers and lakes to any desired extent has been greatly strengthened. This work was for six years most efficiently directed by the late Mr. James W. Milner, and is now in charge of Major T. B. Ferguson, Assistant Commissioner, by whom has been devised the machinery for propagation on a gigantic scale by the aid of steam, and Col. Marshall McDonald, chief of the division of propagation.

The work of the Commission in fish culture has been that of stimulation and co-operation. The efforts of individuals have been encouraged in every way; indeed, there is hardly a fish culturist in the United States who is not or has not been attached to its staff. What was done in improving the methods of artificial propagation has already been summarised, and need not be repeated here.

The same policy of co-operation has been extended to the State Fish Commissioners and to fish culturists in every part of the world.

In 1877, the Commissioner and his staff were summoned to Halifax to serve as witnesses and experts before the Halifax Fishery Commission, then charged with the settlement of the amount of compensation to be paid by the United States for the privilege of participating in the fisheries of the Provinces. The information at that time available concerning the fisheries was found to be so slight and imperfect that a plan for systematic investigation of the subject was arranged and partially undertaken. In 1879 an arrangement was made with the Superintendent of the Tenth Census, with whose co-operation a complete survey of the fisheries was secured.

An elaborate illustrated report upon the Food Fishery and Fishery Industries is now in progress of publication.

Seven annual reports have been published, and one volume of the Bulletin, with an aggregate of 7,006 pages.

These cover the period from 1871 to 1879. Many papers relating to the work have been published elsewhere.

Thanking your Excellency, and you, my lords and gentlemen, for your kind attention, I will close this necessarily long address with the expression of the hope that the fisheries of Europe may derive from this great Exhibition a tithe of the advantages which are certain to result from it to the fisheries of the United States.

DISCUSSION.

The CHAIRMAN called on Mr. R. Edward Earll to be good enough to explain the diagrams and pictures upon the wall.

Mr. EARLL said he had listened with pleasure to Professor Goode's Paper, but national modesty would prevent his commenting upon it, and he would proceed to give a few details of the working of the Fish Commission during recent years. They had learned from this Paper, as well as from Professor Huxley, of the enormous quantity of fish consumed as food by other fishes in the sea and rivers, and it therefore became necessary, in order that fish culture should become practicable, and in any way increase the supply of food in a country, that there should not only be thousands but millions of fish hatched annually. The attention of the Commission had therefore been turned recently towards improving the hatching apparatus, to secure greater economy of space and concentration of work, and also toward sdevising more effective methods for the distribution of fry. Each specialist had taken up a special line of work, and had carried on his investigations until he had either introduced some new form of apparatus which had enabled him to accomplish better results, or had invented apparatus for transporting fry to a greater distance. Attention has also been turned to securing a larger number of eggs than was formerly obtained. At first the practice of the Commission was simply to attend the nets of the fishermen, and take such eggs as might be found in spawning females, but later it was found expedient to collect the fish and pen them until they should ripen, when the eggs could be secured. In Grand Lake Streams, Maine, where the land-locked salmon were hatched, it became necessary to handle a large number of fish at a small cost. If the fish were to be secured one at a time, or taken from the nets of the fishermen, it would take a large number of men to handle them, and the cost of propagation would be enormous. The superintendent, Mr. Atkins, had therefore devised a plan of stretching nets across the mouth of the river which the fish ascended during the spawning season, and turning them from their course into net basins which were placed near the hatchery. It then required no labour to catch the fish except that of stretching the nets and placing the poles. The fish remained in the basin until they were ripe, requiring no food at the time, and the men went out with dip-nets, took them, secured the eggs, and turned the fish back again into the stream. At the hatchery in California, in order to secure a large number of fish, a dam had been placed across the McLoud river, so that they might be intercepted in ascending, and be secured in considerable numbers in the immediate vicinity of the hatchery. At the white-fish hatcheries at Northville, Michigan, pounds had been made along the shore in which the fish were placed for a few days until the eggs were perfectly ripe, so that the [illegible]re number taken, or a very large percentage, might be impregnated. It was also found that the old method of handling the eggs, where they were spread out on trays in single layers, required too much space, and it therefore became necessary to modify the apparatus from time to time so that larger quantities could be hatched. Recently the eggs of the shad had been hatched in jars, holding from 2½ to 3 quarts, in which could be placed 60,000 or 70,000 eggs, each jar being about two-thirds full. It had also been found desirable to concentrate the work of the hatcheries. Formerly it was supposed that these must be built in the vicinity of each important breeding-ground of the fish, and, that more ground might be covered, steam launches came into use: these, shortly before the time for the nets to be hauled, take in tow a number of boats, and proceed along the river bank, leaving men here and there at the various fisheries. After the eggs had been secured, the steam launches again took the boats in tow and returned to the hatchery. This method was found to cause considerable delay, and the success was not all that could be desired. It has since been found desirable to pack the eggs by a method which was not formerly supposed possible—he was speaking now of the shad. They are now packed in wire trays covered with damp cloths and shipped to any hatchery within a radius of forty or fifty miles. Men are now provided with a tent, rations for two months, a few pans, dippers, and pails, and a quantity of trays, and sent to the various fishing shores to remain until the close of the fishing season. Arrangements had been made with one of the river steamers to stop at these different landings to take on board the crates of trays which had been filled with the eggs, and carry them to the hatchery. In this way ten times as much work could be accomplished with the same number of men and an equal outlay of money. Another thing to which Professor Goode had alluded, was the establishment of floating hatcheries. The coast-line of the United States being so long, and the temperature so varied, it was found that the shad spawned along the extreme southern coast in the latter part of January, February, and March; later, about the 1st of May, they were spawning in the waters of Maryland, and later still, in July, on the New England coast. In 1877 floating hatcheries, drawing only 15 to 20 inches of water, were built, and taken in tow by steamers first to the waters of North Carolina; after the spawning season for shad had closed there, they were towed to the waters of Maryland, and the work prosecuted there during the height of the season, and later they were carried further northward. By this means the same plant could be utilised in a number of different localities. Another matter of importance was the building of refrigerators for retarding the development of the eggs until such time as they could be manipulated. The hatchery at Northville would accommodate scarcely more than 100,000,000 eggs, but it became desirable to hatch much larger quantities. A refrigerator building was now being erected, the ice chamber being at the top, with pipes leading down to convey the cold air into the chamber containing the eggs, which were placed on trays one upon another, with an air space between them. The intention was to store the eggs until those in the hatchery had been hatched and distributed, when others could at once be taken from the refrigerator and placed in it. The superintendent, Mr. Frank N. Clark, hoped to increase the quantity hatched in this way from 100,000,000 to at least 500,000,000, and he believed that the refrigerator would enable him to distribute the fish during a period of at least four months, and to extend the hatching period for three months beyond its natural limits.

The MARQUIS OF EXETER said he had been asked to move a vote of thanks to Professor Goode, and he felt that very few words of his were requisite in so doing, for he was sure the whole meeting would concur in giving him a most hearty vote of thanks for the very able, instructive, and exhaustive Paper which he had read. It entered so completely into the details of the great breeding establishments of the United States, that all who took an interest in pisciculture would derive great benefit from it, and it would enable them to improve their own establishments ; he was quite sure that many of the hints he heard would enable him to do so. He was glad of this opportunity of returning his sincere thanks to the Government of the United States and the Piscicultural Department, for the great kindness with which they had answered his questions, and furnished him with ova and everything he required for carrying out his small piscicultural experiments. Those fish which he exhibited in the collection were descended from eggs furnished him by the United States Department at the request of Sir Edward Thornton, and were nearly all American bred fish.

PROFESSOR HUXLEY, in seconding the vote of thanks, said he should have had great pleasure in so doing under any circumstances, but it afforded him particular pleasure to do so because it appeared to him that on considering attentively the results of this large mass of observations and experiments upon the best methods of dealing with fishes of all classes, which had been carried out with such great activity and ingenuity by the United States Commission during the last ten years, there was as good a justification as he could wish to have for the propositions which he ventured to submit on the occasion of the first Conference. He found that, practically, Professor Goode classified fishes into those which were very easily exhaustible, those which were exhaustible with more difficulty, and those which were practically inexhaustible. He would refer, as one particularly interesting case of practically inexhaustible fishes, to the diagram showing the results of the mackerel fishery, and he would beg of all those who had faith in human operations as contrasted with those of nature, to consider that diagram with attention. The great moral of the United States contribution to this Exhibition, and especially of the contribution which Mr. Brown Goode had just made to the Conferences, was that if this country, or any society which could be formed of sufficient extent to take up the question, was going to deal seriously with the sea fisheries, and not to let them take care of themselves as they had done for the last 1,000 years or so, they had a very considerable job before them; and unless they put into that organisation of fisheries, the energy, the ingenuity, the scientific knowledge, and the practical skill which characterised his friend Professor Baird, and his assistants, their efforts were not likely to come to very much good. One of his great reasons for desiring that the subject which Professor Goode had put before them should be laid distinctly before the English public was to give them a notion of what was needed if the fisheries were to be dealt with satisfactorily; for he did not think, speaking with all respect to the efforts made by Sweden, North Germany, Holland, and so forth, that any nation at the present time had comprehended the question of dealing with fish in so thorough, excellent, and scientific a spirit as that of the United States.

The vote of thanks was carried unanimously.

The MARQUIS OF HAMILTON said he had great pleasure in proposing a vote of thanks to his Excellency Mr. Lowell, the American Minister, for presiding on the present occasion. The most interesting address delivered could not fail to form a subject of great interest to all connected with the fishing of this country, but the importance of the occasion had been considerably increased by the presence of Mr. Lowell. His name was familiar to all Englishmen, and wherever he appeared in public his presence was always greeted with enthusiasm, whether it was in making an amusing after-dinner speech or in presiding at an important conference like the present. They not only welcomed him, but they also welcomed other American gentlemen and ladies who were present. They desired to thank Mr. Lowell for the great interest he had taken in this Exhibition from its first inception, and also, as representative of the United States in England, for the great encouragement he had given the enterprise. The American nation played a very important part in the Exhibition; the magnificence and beauty of their exhibit being one of its chief attractions.

PROFESSOR BROWN GOODE had much pleasure in seconding the motion, which was carried unanimously.

The CHAIRMAN, in reply, said as this was not an after-dinner occasion, neither a long nor an amusing speech would be expected from him. He was very much obliged for the warm manner in which the vote of thanks had been received, which he was entirely conscious of not deserving. It was his duty as well as his pleasure to be present that day, and be of what service he could, and he thought he might say without any national vanity that it was the wise and generous appropriation of £10,000 by the American Congress which did a great deal to encourage the Fisheries Exhibition at its outset, and he had been greatly gratified at hearing from the highest possible authority that the American section was distinguished for its scientific arrangement, and, therefore, for its practical utility, and that a lesson might be learnt from it. He was particularly struck by one or two things in Professor Goode's discourse. The numbers which he cited the mind rather lost itself in, as it did in the vast distances of astronomy, but there were some other points which interested him particularly, especially one in which they were informed that the protection of fish in the United States was now due, if he understood it rightly, rather to individual effort, if he might so call it, on the part of societies than to any statutes. That was rather a curious as well as an interesting illustration of one at least of the results of that progress of democracy of which many people stood so much in terror. It was a remarkable fact, and recalled to his recollection something he was told a year or two ago by a gentleman from Pittsburg, who was then passing through London, in speaking of the riots in Pittsburg some ten years ago. He was in London at the time, and, therefore, did not know the facts. This gentleman said it was generally supposed that they were put down by the militia, but it was nothing of the kind ; the rioters put down the militia, but it was public opinion that put down the riots. He said it was perfectly true that when the strike of workmen began it was approved by public opinion ; that people thought the reduction of wages was unwise, that they were low enough already, but the moment the workpeople came to violence public opinion went round to the other side, and they were left as it were in a vacuum in which they could not breathe. The difficulty of protecting anything in a country so wide as the United States he remembered having a practical illustration of himself once, when the State of Maine endeavoured to protect the moose, which was becoming extinct. He, when up in the depths of the forest there, encountered a trapper, who told him that he went 180 miles every winter into the forests beyond the settlements to set his traps. He had a canoe of birch, and on it he had burnt his name, and underneath the title "Moose Warden," and he said he would take care of all the moose that came within the reach of his rifle. Of course it was impossible for any warden under the statute of the State of Maine to approach him ; but he believed the public opinion of the State of Maine did serve as a better protector of the moose. This sort of independence was typified in a fact concerning the American oyster which he had heard that day. The young of the European oyster were contained within their shell for a certain appreciable period, but the young of the American oyster were more adventurous, and were turned loose into the wide world of the oyster to look out and find for themselves. Professor Goode, in the introduction to his remarks, spoke of the importance of the New England fisheries in early times, and that importance could not be exaggerated. The fisheries were what the mines of California afterwards became, and perhaps would turn out to be a more valuable mine than they, but he had omitted one point which was of very great importance, and a point to which Burke alluded in his speech to the electors of Bristol when he spoke of those rude fishermen who had whitened every ocean with their sails. The great value of the fisheries as it was estimated in New England, and in the country at large even more so, was as a nursery for seamen, and one of the things which had impressed him in that Exhibition more agreeably than almost any other was the indication it gave that there were callings which summoned forth all those manly qualifications of daring, endurance, self-reliance, and self-sacrifice in a peaceful occupation which perhaps they had been too easily led to think were dependent upon war for their cultivation. On the other side of the water the men who carried on these fisheries had always been encouraged, and sometimes by special bounties, and so important were they considered that in the State House of Massachusetts over the Speaker's chair there hung a model of a codfish as an emblem of what was then the most important industry of the State. As an emblem of silence he believed it had had no great effect in repressing the eloquence of the Chamber of Representatives, but the thought of it had so warning an effect on himself that he would not detain the Conference longer than to repeat his thanks for the cordial way in which the vote of thanks had been received.

OYSTER CULTURE

AND

OYSTER FISHERIES

IN

THE NETHERLANDS.

BY

PROFESSOR HUBRECHT,

MEMBER OF THE NETHERLANDS SEA FISHERIES BOARD, AND A COMMISSIONER FROM THE NETHERLANDS TO THE INTERNATIONAL FISHERIES EXHIBITION.

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CONFERENCE ON JUNE 29TH, 1883.

OYSTER CULTURE AND OYSTER FISHERIES IN THE NETHERLANDS.

Lord HENRY SCOTT, M.P., took the chair, and in introducing Professor Hubrecht, said this was a subject in which he felt deep interest, and had had some practical experience. Being the owner of a property on which there was a native bed of oysters, this had drawn his attention to the subject, and the importance of, if possible, doing something to restore the stock of oysters upon it, which he found to be deficient. The stock of British oysters was acknowledged to be daily diminishing, there not being enough to meet the ordinary supply, so that recourse was obliged to be had very largely to foreign oysters, and even they were not sufficient to supply the demand for this excellent article of food.

Professor HUBRECHT spoke as follows:

About six weeks ago I had the advantage of being present at a lecture "On Oysters and the Oyster Question," which was given at the Royal Institution by one of your most eminent biologists, Professor Huxley.

It would be very presumptuous on my part to go over the same ground once more, after that very able discourse has come under the notice of you all, and I wish to limit myself to a few statements concerning the oyster fisheries and oyster culture in the Netherlands.

Time was when oysters from natural oyster-beds were very plentiful with us. These beds were situated, partly in our Southern province of Zeeland, partly towards the North in the inland sea which we call the Zuyderzee, at the spots indicated on the Map. The oysters were brought to market in Amsterdam and were partly exported to Germany at a price which bears no comparison at all with what is at present paid for them.

This having been the state of things a good many years ago, it is a pity that we have to recognize the fact of one of these natural beds being nearly destroyed. There is no serious doubt but this destruction has come about by overfishing. The few oysters that are left are only worth the notice of the Nieuwe-Diep fishermen in the summer time when they are not employed in any other fisheries, and even out of their number only a few pay regular visits to those parts of the Zuyderzee where oysters may happen for the moment to be just a little more numerous than usual. There is no regular oyster trade in that part of the country.

The oyster trade with us is for the present concentrated in the province of Zeeland, where, as was noticed before, a second natural oyster-bed of some extent has existed. This bed was very fast on its way towards extermination and would certainly have followed in the wake of the Zuyderzee beds, had not oyster "culture" at the right nick of time stepped in and replaced "oyster fishing." The already impoverished regions have since made rapid strides towards their maximum of productivity, and it is from them that the large numbers of so-called Dutch oysters or Dutch natives, which if I am not wrong are high up in the scale of merit according to the verdict of London palates, are derived.

It was in 1870 that this change of system was effected. Up to that year fishermen from the small village of Yerseke and from other hamlets round the so-called eastern arm of the River Schelde regularly fished and dredged on this bed in the five winter months (October—February). There was a close time for oyster fishing (during which period it was strictly prohibited) of no less than seven months, from March 1 to October 1. Still it was generally accepted that notwithstanding these measures the bed gradually became impoverished.

About the same time that it was decided upon to no longer allow public fishing on these beds but to give them into the hands of oyster-culturists, another important change had been effected in the geographical situation of the oyster-beds. A railway-dam had been constructed across the eastern arm of the Schelde where it was narrowest, and this practically changed the nature of its waters. It now became, as you will see from this map, a deep inland bay, instead of being one of the arms of the Schelde delta through which part of the fresh water from this river could flow towards the German Ocean. This change has of course affected the salinity of the water, and it may be safely inferred that this has not remained without influence on the oyster-beds of the eastern Schelde and their productivity.

The first impulse towards prohibiting public fishing on the so-called Yerseke oyster-bed was given by private gentlemen, who in 1867 had visited the Arcachon oyster regions and who applied to government for aid towards an investigation of the condition of the Yerseke-bed. The result was that in 1870 and 1872 Government, or rather the Minister of the Finances under whose control are also the fishing waters of the country, withdrew the Yerseke oyster-bed from public fishery and leased it for purposes ot oyster-culture to private individuals, after having divided it into plots varying in size from 12 to about 150 acres. The rent was to be paid yearly, and the time up to which it might be retained for the same rent was 15 years, facilities being offered to those who wished to give back their allotted plots before the expiration of the 15 years' term. In 1885 the whole of the Yerseke oyster-bed would come back to Government and new agreements would then be decided upon. As this period is now rapidly approaching it was wisely decided upon by Government not to wait till 1885 before re-letting the bed, but to do so at least three years before the expiration of the present leases. So last year this new leasing took place, and the same 7720 acres which form together the Yerseke oyster-bed and which have been leased from 1870 to 1885 for a yearly rent of about £1720, will in 1885 bring into the Exchequer a yearly amount of £28,765. These figures speak for themselves and go far towards demonstrating that oyster-culture in the regions we are speaking of is a success. The new lease runs for thirty years, with the right on the part of the lessees to give up their allotments every five years.

The extraordinary increase in value just alluded to of the different portions of the oyster-bed, has not similarly affected all portions of that area. I will give you figures to demonstrate this; but I must first call to your mind, that in the practice of oyster-culture, certain areas are principally devoted to "growing" the oysters, others to collecting the spat, and that the value of a certain area is principally determined by the intrinsic qualities which it is supposed to possess for the one or for the other of these operations.

The collection of the spat essentially consists in the process of bringing out into the sea-water tiles, like these I have here on the table, covered by a layer of chalk, which is afterwards easily removed, together with the young oysters adhering to it.

These tiles are brought out in millions at the time when the oyster spat is expected to be most plentiful. If brought out too early, they get covered with a layer of earthy deposit, or lose the roughness of their surface, and the spat will not then fix upon them; if brought out too late the spat may have altogether disappeared for that season. It is thus a very important question when and where to deposit the collecting tiles. Up to the present, oyster-culturists have been guided mostly by empirical notions, tradition and experience having decided what portions of the sea-bottom were most fertile for the collecting of the young. Theoretically this question is dependent on circumstances which are, indeed, complicated. It must first be asked, where are the oysters that furnish the spat? secondly, how long does this spat swim about independently, before fixing itself? thirdly, what is the influence of the currents in the vicinity of the mother oysters upon the distribution of the spat over a certain area?

It has been the object of a series of investigations planned by the Direction of the Dutch Zoological Station, of which I am a member, to try and get definite and reliable facts concerning these movements of the spat. I am sorry to say, that in this respect our results up to the present moment are rather scanty, although we are continuing our exertions. One fact is generally accepted, viz., that exceptionally good localities for spat collecting are those where there is a strong current of fresh sea-water at each tide in the immediate vicinity, and where, at the same time, this current is broken by headlands or other causes, so as to produce counter-currents of much reduced intensity. The spots where these counter-currents occur are very much valued, as are also those deeper pits here and there found in the sea-bottom, above which a sort of whirlpool is apt to occur. It would seem that in both these cases, the spat is more easily deposited, is, so to say, precipitated, on the collecting-tiles or other substances (shells of dead molluscs, &c.), to which it can adhere. Localities answering to the above requirements are found on the spots I will indicate on the map.

In order now further to bring before your mind how the value of one locality above another for this and other purposes of oyster-culture, appears to be gradually established by experience, and is, indeed, recognized by those interested in this industry, I have promised to give you a few comparative numbers of the sums for which the same plots were leased in 1870, and will be so from 1885 forwards :—

Allotment No. 162, size 12 acres, was leased—

			In 1870 for	1*s.* 8*d.*	a year ;	will be in 1885	£202	a year.
No. 163	12	ac.	„	1*s.* 8*d.*	„	„	£227	„
„ 164	12	„	„	13*s.* 4*d.*	„	„	£252	„
„ 176	12	„	„	£22 10*s.* 0*d.*	„	„	£508	„
„ 220	120	„	„	£25 18*s.* 0*d.*	„	„	£33 15*s.*	„
„ 138	12	„	„	£18 10*s.* 0*d.*	„	„	£762 10*s.*	„

Others have gradually come down in the market, as for example—

No. 280. 24 acres brought in 1877, £45 16*s.*; in 1879, £1 10*s.*
„ 415. 18 „ „ £2 1*s.*; in 1882, 10*d.*

The fluctuation is, as you see, indeed considerable, and only rivalled by that mysterious fluctuation of spat which, in the breeding season, is carried to and fro at each turning tide, all through the basin of the eastern Schelde.

A question which we were also eager to answer in continuing our investigations at the Zoological Station, was this: From whence is the spat that occurs in such myriads on the Schelde essentially derived? The interest of this question was increased by the fact, that among the oysters which were dredged on the cultivated beds, the number of ripe specimens carrying eggs, was very rare. This was partially explained by the fact, that the oysters are generally collected and sent into the market *before* the female generative products have attained their full maturity. However, this circumstance made it all the more wonderful that still the so-called *fall* of spat had, during the last ten years, been on the whole so considerable, the unproductive years being generally more the consequence of other circumstances than of the absence of young oyster larvæ at the right season.

It must, moreover, be specially mentioned, that after the Yerseke bed had been withdrawn from public fishing, no obligatory close time for oyster-fishing was ever prescribed. The lessees could dredge for their oysters at whatever time of the year they liked. That they did not generally do so in summer was, in the first place, for fear of disturbing the growth, the delicate edges of the shell being at this period more particularly liable to break; and secondly, because the oysters are found to be less palatable at this time of the year. I hardly presume that they were already convinced of the truth of Professor Huxley's view, which he repeated in his lecture above alluded to, and which I have no doubt is the right one, that a close time for fishing on oyster-beds may be very serviceable; but that there is absolutely no reason to see why it should be more so *during* the spawning time than either *before* or *after*.

The great thing appears to be to leave a fair portion of the oysters on or around a natural bed, wholly undisturbed for a series of consecutive years. Now such an arrangement was never carried out *intentionally* on the Yerseke bed, every portion of it and of the whole eastern portion of the Oosterschelde having been leased for purposes of oyster-culture.

Continuing our investigations as to the source from whence the spat might be naturally derived, we were thus led to suppose that natural beds of a certain extent were present in the western portion further seaward. Dredgings were undertaken by means of a government steamer, but they gave a negative result, and this coincided with what had already been told us by fishermen, i.e., that no such natural beds existed.

One day, the idea occurred to us, that we were looking the wrong way, and that what we were searching for was much closer to us than we expected.

The fact is, and hitherto I have not yet mentioned it, that a regulation which has been rather strictly attended to, and which had originally been proposed by those government departments that are in charge of the maintenance of the dykes defending the country against invasions from the sea, runs thus: *it is not allowed to use dredging implements of any description for the capture of fish or mollusks within a line of* 500 *meters distance from the coast.* The reason of this prohibition was that the foot of the dykes running out into the sea is in several spots protected with specially constructed stone defences which might be seriously damaged by dredging, and might thus weaken the dykes, endanger the land behind them, and, at all events, necessitate expensive repairs. It was the more easy to enforce this regulation because dredging for oysters within this 500 meter area, wherever the stone-works had been constructed, was attended with great danger of losing the dredge, as it easily got entangled in one way or the other.

Now to this band of nearly a quarter of a mile in width which surrounds the Schelde basin on all sides, our attention was more especially directed. A diver was sent down at numerous different points to make the explorations as thorough as possible. It was thus brought to light that really, wherever the stone-works alluded to stood out on the sea bottom, which at those localities rapidly sloped down towards deeper water, there was a more or less numerous, at some spots even a very profuse crop of oysters of all ages, which, in consequence of the regulations above mentioned, had never been disturbed and bore the evident traces of this. When at a few localities no oysters were found on the submarine stone-works it was to be ascribed to these having been newly constructed or repaired, or to their having been covered over with sediment.

The results of these diving operations were mapped out and are shown in the diagrams I have before me. The long band-like patches of oysters follow the stone-works, and both to seaward and towards the land, where a muddy bottom is prevalent in their immediate vicinity, no oysters occur.

The localities that have hitherto been thus investigated are shown in this map, and I may fairly infer that the continuation of our researches with the diving apparatus which are contemplated also in this summer, will enable us to trace the confines of this natural oyster-bed with precision.

It is hardly doubted by any of us, nor by the professional oyster-culturists themselves, who have a more direct interest in the productivity of the eastern Schelde, that here, indeed, we have before us the principal source from whence the spat is yearly for the greater part derived, and everybody appears to be anxious to maintain the present state of things and to have the prohibitory clause against fishing within the 500 meter area most strictly observed.

The investigations concerning the oyster questions which were carried out by means of the transportable Zoological station, and which have just been alluded to, also extend in other directions. The anatomy of the oyster has been carefully inquired into by Dr. Hoek, and I have before me his elaborate treatise with numerous illustrations. The embryology of the oyster has been investigated by Dr. Horst, who is still continuing the researches, part of which are already published. The physical circumstances are similarly inquired into, and series of observations concerning temperature and salinity of the water are repeated three times a day at different points of the Schelde.

In the course of this summer our attention will be more especially directed to the process of fixation of the larvæ when at the end of their free life they settle down on some hard substance where to develop into a full grown oyster. To get hold of the largest number of young oysters, fixed in this way to transportable apparatus, is a most important object to all oyster-culturists, and this problem is before them once every year at the breeding season. All the different forms and shapes of collecting apparatus, some of which are here on the table, and which you will find in great variety in the different departments of this Exhibition, tend to the same object. Still the process of being obliged to bring these out into the open sea, hoping that the invisible spat may fix down upon them in great quantities, may to a certain extent be compared to a man trying to catch birds by throwing his hat at a passing flock.

In order to bring this matter within the reach of man's voluntary interference, different attempts have been made to let the oyster give off its spat in an enclosed space where it might be collected at leisure on the apparatus which was deposited in the same enclosure. Such experiments have—in our country at least—always led to negative results. However, we are not certain that they were taken with the necessary precautions, the water being only very rarely and partially changed. The consequence of this must have been extensive mortality of the spat by the water becoming de-oxygenated, and loss of spat at those —whenever so few—occasions on which the water was partially renewed.

In our experiments we wish by all means to eliminate such sources of error. We have had the free disposition given to us, during the whole time of the experiment, of one of the largest oyster parks. It is represented in this figure. At these points there are inlets for the sea-water that can be opened and shut, and the volume of water forming the oyster park is divided by smaller dykes and by wooden enclosures into several compartments.

One of these has been entirely separated from the rest, and is specially devoted to the purpose of our experiments. In this separated portion, here indicated by dark blue, and which has a superficial extent of about a quarter of an acre, about 10,000 mature oysters are about to be deposited, the floor of the compartment having been covered by apparatus for collecting the spat. As long as the breeding season has not yet so far advanced that the spat is set free the water is changed with every tide. In the meantime we have here put up a steam engine, and by this we intend to bring about artificial oxygenating of the sea-water the moment the spat makes its appearance. We then shut all the exterior inlets of water once for all and continue our experiments during the rest of the summer with the water at that moment contained in the park. In this way there is—1st, no possibility of the spat escaping. 2nd. No possibility of spat being introduced from outside, which would interfere with the reliability of eventual results.

To make a comparative experiment with different methods of aerating the sea-water we have divided the space here indicated in two halves. In the anterior portion a revolving axis with blades attached to it causes a continual current and at the same time introduces a certain amount of air. In the posterior portion compressed air is introduced into the water by a very large number of small orifices through which it is continually pumped, and from whence the air-bubbles must ascend towards the surface.

In this way we hope to provide our young oyster larvæ with a fair supply of oxygen, to the absence of which we ascribe the failure of previous experiments. Nobody can, of course, predict as to whether we shall be more successful, and whether in the breeding season we shall find the different sorts of collecting apparatus we are going to experiment with, profusely covered with spat; but still it was our conviction that we ought to give the question a fair trial, the more so since the experiments of Bouchon Brandely on the French coast have put it beyond doubt that with the Portuguese oyster (*Ostrea angulata*), artificial fecundation and collection of the spat in myriads is quite feasible. The market value of the Portuguese oyster is, however, very low; the oyster has quite a different shape from ours, and is generally considered of a very inferior flavour.

This example, though encouraging, does not, however, admit of the conclusion that we have equal chances of success with *Ostrea edulis*, our north-European oyster. Part of the development of the young of the latter species takes place within the shell; and as this is not the case with the Portuguese oyster, artificial fecundation in the former species would be very hazardous.

For this reason the plan for the experiment has been traced in the way I have just now explained.

I have dwelt at some length upon these experiments because they will bring before your minds the phase at which the theoretical questions with which oyster-culture has to deal have at present arrived.

As to its practical side I am afraid time will not permit me to give you a fair description of the different implements and processes. Moreover, I believe most of you are sufficiently acquainted with them; and if not, there is no such opportunity as that offered by this Exhibition to study them in full for yourself.

In terminating I must not omit to mention that the favourable results of oyster-culture in the Schelde have directed the attention of government to the re-stocking and the methodic improvement of the Zuyderzee beds on the same plan that has been followed since 1870 for the less over-fished Zeeland bed. As yet these measures are not far advanced, but it can hardly be doubted that in the course of a few years a new source of the prized delicacy we have been considering to-day will there be opened, the natural conditions having on the whole remained the same since the time these beds were so plentiful.

DISCUSSION.

Mr. **Fell Woods** said when the somewhat imperfect report of Professor Huxley's address at the Royal Institution was published he was impressed with some fear whether henceforth Professor Huxley must not be classed amongst the enemies of the oyster; but the inaugural address he had since delivered to this Conference somewhat re-assured him, because he had indicated plainly that there was a possibility that certain restrictions on oyster-dredging might produce some valuable results. Unfortunately he did not go so far as to say that they would actually produce such results, and so far as he restricted himself he was not quite sure that he had come over to the side of the oyster as against his enemies. He feared he did not place sufficient value on the close time during the spatting period. It was true, of course, that if a large amount of dredging went on during the other periods of the year the effect of the close time during the spatting period could not be so great as it otherwise would be; but in proportion as any oysters were left on the ground owing to the restrictions of close time so must the probability of an increase in the oysters be favoured. Some years since he (Mr. Fell Woods) showed that the period of spatting of the various oysters round the coast was not the same, and in any arrangement which might be made that fact ought to be borne in mind. There were certain periods applicable to certain oysters, and other oysters need not be interfered with during a portion of the period, but might be dredged, their close time coming at a somewhat later period. The restrictions which might be demanded beyond those of a close time were certainly of very great importance; they might be taken as including the question which attached on the one hand to beds within a three-mile limit, and on the other to those which were beyond that limit. But to some extent similar restrictions would need to be applied to both classes. They must apply to the age of the oysters at the time of their removal; also to the parts of the oyster beds which were to be dredged from year to year; to the removal of culch from those beds, and also possibly to the question of some license or fee to provide arrangements for watching and cleaning where required. It would be absolutely impossible on such an occasion to go into the details of this matter, but some years since he published a pamphlet, which he should be happy to submit to Professor Huxley and Professor Hubrecht, in which he had gone somewhat closely into these matters. The reply generally made to any demand for any regulation of oyster fisheries was that so far as concerned the public beds outside the three-mile limit, they would be interfered with by those countries with which we had no fishery convention; but that argument merely showed that we ought to extend our fishery conventions to all neighbouring nations, and he believed that other nations were far more ready to adopt these restrictions than England was. Another matter which was constantly urged was the question of granting what were called "several" fisheries—the allotment of certain grounds to private parties, who undertook the custody and working of them, on a similar plan to that adopted in Holland. To effect this our present arrangements were scarcely what they ought to be, and measures more just to the neighbours should be provided in all these cases, and careful arrangements made with those who undertook them. Another deficiency was that nothing like proper protection against poaching was provided. The wisdom of restrictions and regulations of course depended entirely on their character, and the burden of proof lay on those who advocated them; but he could not help thinking the reference Professor Huxley made to what he thought was a comparative failure of the restrictive measures undertaken by the French Government, especially at Arcachon, left out of account a fact with which possibly he was not acquainted, viz., that when social or political circumstances appeared to demand it, the fisheries at Arcachon had not adhered to the regulations laid down, but permitted a considerable amount of dredging, in contravention of their regulations. The Paper they had just heard was certainly of the greatest value, and the fairness of spirit with which Professor Hubrecht had brought forward facts which might be used either favourably or adversely to Professor Huxley's view was most noticeable. From long experience of experiments somewhat allied to those now brought forward, he might say that Professor Hubrecht seemed in the main to corroborate views which he (Mr. Fell Woods) had printed some six or seven years ago. The most important point, in his view, was that any questions with regard to regulation and interference in oyster fisheries should be thoroughly discussed again before any decision was arrived at, either to neglect or interfere with them.

Captain ANSON remarked that Professor Hubrecht said these beds in Holland had suffered from over-fishing, and while of course he was willing to accept that, he should have been glad if a little further information on the subject had been given. He would also say that what was sauce for the goose was not sauce for the gander, and that if the oyster beds in the Thames or near the Mersey were allowed to remain undisturbed for two months they would be simply ruined, mudded up and covered with ooze, and the oysters would all be eaten by crabs. He should also like to ask what was the depth of water on the Dutch beds, and also whether, as the result of his experiments, he could say the temperature altered the spatting. He believed that this matter had the greatest possible effect. He would mention one fact which perhaps tended to further the view that had been put forward, namely, that between Cancale and Grenville the French Government had established a permanent reserve, where no dredging was allowed. He went there dredging last year, and the oysters were certainly most numerous; they appeared to exist in millions. Another fact of some interest was this, that when making some new beds at a place called Arennes, the barriers between two of the beds broke down, and there was a small tramway that went out to the bed which was being constructed. It happened at the spatting season, and when the dyke was finished it was found that so many oysters had adhered to the rails, which had been constantly used by the tramway, that these rails were kept as oyster collectors, instead of being taken up to be used as rails. In Buckland's Museum would be seen a specimen of a flat iron covered with oysters, and, as Mr. Buckland remarked, when the oysters were in a sticking humour, they would stick to anything, and if the washerwoman who used the flat iron had been at the bottom of the sea, they would have stuck to her.

Captain AUSTIN said he represented a large oyster company which had large beds at Whitstable, and also in Ireland and Scotland. He should second the suggestion of Mr. Fell Woods that there should be discussion on this oyster question, so that some practical conclusion might be arrived at. But as far as he gathered from Professor Hubrecht, he said it was nothing but the old oysters that bred, whereas at Arcachon they dredged every old oyster off the ground, but would not allow the small oysters to be taken. With regard to close times he quite agreed with Professor Hubrecht that no kind of restrictions would do any good. A little fact was worth a good deal of theory. They had a large bed in Scotland where no oysters were dredged for five or six years, and a boat could go there and catch 2000 in a day, which any one would agree was a fair sprinkling of oysters, but there was no vestige of spat to be seen in the place of any sort. That was entirely contrary to the over-dredging theory. On the beds of Whitstable, which were about two miles square, there were from 25 to 30 millions of old oysters, but there had practically been no spat there since 1858 or 1859. There was a little, of course, every year, but nothing to speak of. If the over-dredging theory were right, why was there no spat there? Two years ago there was a large fall of spat, but, probably owing to the cold August, it disappeared and died off after getting to about the size of peas. In Ireland the Fishery Commissioners closed their beds absolutely for three years, but at the end of three years the fishermen could not catch as many oysters as they were catching when the beds were closed. The only fact that the over-dredging theory had to go upon was that the oysters were not there, and of course it might be said that if those which had been dredged had not been taken they would have remained. In his opinion there never would be cheaper oysters until there was a natural reproduction, and that would only come when the weather was favourable. With regard to breeding, he should like to have a little further information. With regard to artificial breeding in Holland, he was inclined to think that it was a loss to those who undertook it. At Arcachon he had asked several of the great breeders, and they all told him that breeding oysters artificially did not pay. It paid individual fishermen who worked themselves, but it did not pay to breed on a large scale even at present prices. He thought the rents named in the paper were fancy prices, and should like to hear further particulars as to whether the matter was a commercial success, and he hoped there would be a further and more complete discussion on the whole question.

Mr. F. G. BROWNING (Whitstable) said that in the neighbourhood of Whitstable for the last 50, 60, or 80 years there had been more parent oysters than any person would think of stocking a new ground with, consequently it was not the want of parent oysters which caused the scarcity. But during the memory of man there had not been more than six or seven spatting seasons, and when there was abundance of spat it had been when the stock of parent oysters was reduced to the lowest ebb. He should also like to ask what was meant by ripe oysters carrying eggs, because he was under the impression that the spawn for all oysters was eggs.

The CHAIRMAN said they were all very much indebted to Professor Hubrecht for his very interesting Paper; but there were still several points left a little obscure, on which further light would be welcomed. Some of the remarks which had been made tended in some degree to a doubt as to the success of oyster-culture; but there was no doubt that beginning at Arcachon and finishing off in Holland, whatever were the methods adopted by the French, Belgians, or Dutch, they could claim at any rate the merit of success, for they had enormously re-stocked their ground and replenished their oyster-beds, and he could not think, that as regards climate, tides, and the possession of the estuaries on the coast, we were in such a totally different position, that we could not with the greatest advantage, imitate some of the methods by which this success had been obtained. It seemed desirable to separate the question of regulation from that of cultivation. With regard to that of regulation, foreign governments possessed a great advantage over our own, they could do many things which we could not do, and which it would be impolitic on our part to attempt, unless thoroughly supported by the great fishing industries of the country. With regard to all these questions, the first thing to do was to impress on the minds of the fishing population the necessity for these regulations, and that if carried out, although they must be irksome for a time, they would be eventually for their benefit. It was also very desirable that there should be further discussion on this point; but that hardly came within the scope of the present meeting. With regard to the cultivation of oysters, they had evidence of success in the quantity of breeding which took place on the coast of France, and he was rather surprised to hear from Captain Austin that it did not pay. He was aware that several companies had been established, and that a good many of them had been wound up, and therefore it was no doubt true that the smaller men had been the most successful commercially; still, the nett result was a production of a great mass of oysters, large reserve beds were kept, on the idea that from them a great portion of the spat was produced; but it must be remembered that the climatic resources of the country were considerable, and there was no doubt that owing to the higher temperature of the water at the critical period, oysters there had not the same difficulty to contend against as they had in England. In Holland, however, the climate could not be better than our own; but he believed the spat fell much later in the year, towards the end of July or August, and at that time, as he understood, the temperature of the water in the basin of the Scheldt would reach 70° Fah. If that were the case every year, it might have an important bearing on the production of oysters. He did not see that it could be the result of the climate; but it might be the result of currents of water—perhaps a portion of the Gulf Stream, which touched that part of the coast. The great advantage of the method pursued in Holland seemed to be this, that every year there was a fall of spat, filling the great basin which had been described, and the cultivators had nothing to do but to place their collectors above and below low water mark, in order to collect this natural floating spat. Now, it must be admitted that for many years past there had been no natural floating spat on the English oyster-beds at all. The question was, did that arise from the small stock of oysters, or was it entirely climatic? He could quite understand what had been said by Professor Hubrecht about the enormous advantage of leaving portions of the shore undisturbed where a large stock of oysters was maintained, and it was a well-known fact that the water near the shore was warmer than that further out. He had known the water in his river at Beaulieu from 75° to 78°, that temperature being produced by its water being so shallow. If, therefore, the breeding oyster lay within a short distance of the shore, he could perfectly understand that the warmth of the water would bring them forward to maturity, and thus this large quantity of spat might be derived. The breeding of oysters artificially in ponds had been tried in this country, and he had tried it himself; but whether from want of experience or carelessness, had not been successful in bringing any large quantity of the oysters which were bred to maturity. In 1878, he bred two ponds quite full of

oysters, probably eight to ten millions; but he believed from 25,000 to 30,000 was as many as were ultimately realised. He could not attribute that to any failure of the climate; but he believed it was due to inexperience and mismanagement. In 1880, a large quantity of oysters were bred in ponds at Wootton in the Isle of Wight, and certainly, up to the season of 1881, they were in a most excellent condition, and if they had been properly cared for must have been saved and brought to maturity; but other matters interfered which prevented their being so. He did not believe there was any great difficulty in breeding oysters in ponds in this country, except that they were really at the mercy of the climate, because in shallow ponds the changes of temperature were so rapid, that the passage of a hail-storm over it would utterly destroy the whole of the spat that would be falling there. He had never thought it necessary to aerate the water; but let it in and out every day with the tide. The state of the oyster when in embryo, would rather lead to the conclusion that in the day he naturally floated to the surface towards the warmth of the sun, and at night, when it was dark, sank to the ground, so that it was not difficult by an arrangement of upper and lower sluices, to arrange for a continual flow of fresh water into the ponds. The greatest difficulty of all in breeding oysters, was the uncertainty of the fecundity of the spat itself. He had seen ponds perfectly full of spat, with every prospect of coming to maturity, and then found in a short time that it had all disappeared. There was a good deal of truth in what had been said about the collectors. There was nothing to which oysters
'd adhere in greater quantities than a smooth piece of
so that actual roughness did not appear to be a
ty; what they heard most about, was perfect clean-

liness ; if anything grew on the collectors when the oyster-spat was forming, he was satisfied that the oyster would not fix on it, and finding the ground already covered by some other organism, it would die. That was one of the difficulties in pond culture, because the growth of seaweed itself in pools was much more rapid than in the sea, and if you were not fortunate enough to have the oyster-spat soon after the ponds were filled, the result was, that when they did spat, weeds were grown, and there was nothing for them to fix upon. Another great difficulty was the expense, and unless you could really secure a good fall of spat, it would not pay, unless you were fortunate enough to collect such a quantity in one year as would pay for several. The mortality in the oyster-spawn was one of the most remarkable features in the whole natural history of the oyster. The European oyster would produce over one million of eggs, and American oysters nearly five times as many, so that it was evident an enormous proportion must die. If by any knowledge they could acquire with regard to the regulation of the oyster fisheries, they could get a large reserve—not of course on muddy ground where they could not be left without moving—there seemed no physical difficulty in following the example of their friends in Holland, and collecting artificially the natural fall of the spat. It they took the area of the Solent or the mouth of the Thames, and thought of the enormous number of oysters which there ought to be in those districts, and how the tides must, owing to the natural eddies, flow backwards and forwards, one could hardly doubt that the spat might be collected, and it seemed to him that we might with advantage follow the system carried on there, and so do something to replenish our native beds. The British native oyster was the best that grew, though he was ready to give great credit to the Dutch oysters, which probably came next to it but it was a great mistake for any one to suppose that by bringing a French or Dutch oyster, and putting it into English beds, that it was converted into a native.

The MARQUIS OF EXETER then moved a vote of thanks to Professor Hubrecht for his valuable paper.

HIS EXCELLENCY COUNT BYLANDT had much pleasure in seconding the motion. He was very glad that some gentlemen present had touched one important subject in regard to artificial oyster-culture, viz., the temperature of water, but unfortunately that was a fact beyond human control. It was different in different countries, and we must all submit to the consequences. Some doubt had been expressed as to the success of the artificial oyster beds in the Netherlands, but it seemed to him that that question must be left to those who were willing to pay every year increasing rents to the Treasury for the beds they leased, and as to the figures which had been given there could be no doubt. One gentleman touched on an interesting subject when he referred to the desirability of international convention with regard to fishing. No doubt that was a matter of great importance, but how it could apply to oyster fishing he was at some loss to understand, because if he was not much mistaken oyster-culture meant the creating of artificial beds which were generally established within the territorial waters of every country, and where he did not believe foreigners were allowed to fish. For all other purposes the mutual interest of all nations was guaranteed by conventions, and he was quite sure his country would be ready to join in any convention for that purpose. He was so much a layman in this matter that he did not dare to go into any further details, but he might tell the meeting little story, which might amuse them, and certainly puzzled him. The King of the Netherlands during his recent stay here reminded him that he had been appointed President of the Netherlands Committee, and therefore he should expect not only a lengthy report from him on the Exhibition, but also an essay on the possibility of getting fish without bones. He very much feared that even with the assistance of his friend Professor Hubrecht he should not be able to meet His Majesty's wishes except by sending him a specimen of the British oyster, which he believed was the only fish that answered the description.

The vote of thanks having been carried unanimously,

Professor HUBRECHT, in reply, said he might inform Count Bylandt that a fish without bones had already been found and was present in the Exhibition, but he regretted to say that its dimensions were so exceedingly small that it could never form an article of diet for the Royal table. With regard to the question Mr. Browning had brought forward as to the age at which the oyster produced eggs, he would remark that from the eggs the spat was evolved. When the eggs had been impregnated they gradually changed into a state of larvæ, and these larvæ, which were afterwards set free in the sea water, formed what was called the spat of the oyster. The spat was nothing but the impregnated eggs, having become larvæ, swimming about freely a certain time, and afterwards fixing on to some object where they could grow into oysters. The age had been carefully investigated at which oysters produced eggs out of which spat could be evolved, and now it was quite clear that in the Schelde oysters of three or four years old contained such eggs most abundantly. Instances of oyster larvæ produced at the age of two years were less common, at one year rarer still.

The investigations of Dr. Hoek on this subject were published, and to them he would refer Mr. Browning. As to the question of certain oyster beds in Arcachon, as stated by Captain Austin, not having a vestige of spat, although there were a large number of mature oysters, he quite agreed with the possibility. The great question was, where had the spat that had been produced on this oyster bed gone to? As he had already stated, they did not know how long spat remained suspended, and it was generally believed that this might be three or four days, and thus the spat which had been set free out of the shells of the ripe oysters forming a given bed, might have been carried away by currents miles from the native place, and deposited elsewhere, or drifted away to sea without even growing to mature oysters. Next came the important point with respect to the "fall" of spat on the beds which were leased for the purpose. There was in all probability no region so favourable as the inland bay of the eastern Schelde of which he had spoken. On many of the English beds situated on the coast, the moment the spat had been produced it might easily be carried away either to some distant point of the coast, or out to sea; but what happened in the Schelde was somewhat different, and had been investigated very carefully. Each tide taking about six hours to ebb or flow, a floating object which also registered the deeper undercurrents—at least approximately—and which was set afloat above the oyster beds, had been carefully noticed at the beginning of the ebb. It of course went seawards; but it had not yet reached the ocean when the ebb was exhausted, and it was brought back again by the flood tide. It was greatly to this oscillating movement

large bulk of water, which did not allow of the spat being so easily carried out to sea, that in his opinion must be ascribed the fertility of this region as an oyster producing locality. He feared that if the arrangement contemplated were carried out, and they were going to have oyster beds established in the Zuyderzee, they would have greater difficulties to contend with similar to those from which England and France were suffering, and they would have to look out carefully for some spot which in that respect more nearly resembled the situation of the Schelde. As to whether the artificial oyster-culture had been a success he could not deal with that point at length, Count Bylandt having already referred to the figures. In addition, he might say that whereas in 1870 the neighbourhood of these beds only consisted of very poor hamlets, at present they were most flourishing villages, and some of the old lessees who had from 1870 to 1885 held allotments there had re-invested their money in the new leases beginning in 1885. Fancy prices might have been given in individual cases, but on the whole the increase from £1,700 to £28,000 as yearly rent for the same 8,000 acres was perfectly genuine. With regard to the observation made by the Chairman as to the disappearance of the spat, he could well conceive that when the spat had been produced in enclosed parks great mortality was observed, so that no real results were obtained; it was to a great extent caused by the water not containing enough oxygen. He had been occupied to some extent with embryological researches on various marine animals, and he had found that if he only took care that a fair supply of oxygen were pumped into the water he could develop many marine forms of animal life, and keep them healthy for a period of eight weeks and longer, in no greater space than a large tumbler, without ever changing the water. With regard to temperature, it had always been observed that it was necessary for the water to be 68° or 70° in order to get a large number of spat on the tiles. He concluded by moving a vote of thanks to Lord Henry Scott, who had honoured him by presiding on this occasion.

The motion was seconded by Dr. DAY, and carried unanimously.

THE

FISHERIES OF CANADA.

BY

LOUIS Z. JONCAS,
SHERIFF OF GASPE, AND AN EXECUTIVE COMMISSIONER FOR CANADA
AT THE INTERNATIONAL FISHERIES EXHIBITION.

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CONFERENCE ON MONDAY, JULY 2, 1883.

The Honourable A. W. McLELAN (Minister of Marine and Fisheries of Canada) in the Chair.

In commencing the proceedings, the Chairman said Canada was a comparatively young country and might not be supposed to be as much interested in fisheries as some of the older countries, and some persons who had heard of Canada and the extent of the country and the diversity of employments would wonder why with so sparse a population there were any fishermen or any fisheries to speak of, when fishing as had been shown already was so much more dangerous and involved so much greater risk to human life than any other occupation. It was true that they had a large extent of country, and there was employment for all those who were there, and for all the millions who might come upon the land, but it was also true that although they had mining industries and although in the north there were vast forests from which lumber was sent to various parts of the world, although it was true that a comparatively small portion of the fertile soil was cultivated, yet it yielded abundance of the choicest food in its harvests and flocks and herds for all the people of Canada, and a large surplus to export; and the men who lived by the sea-side and on the banks of the rivers and by the lakes found so great a temptation to engage in fishing that they could not withstand it. He believed they had as large a proportion of their people engaged in that occupation as any other country in the world. In the British Isles, where population was teeming, and every pursuit was crowded by people desiring to work that they might have bread, a large number were engaged in fisheries, but yet in Canada with their sparse population there were four times the percentage engaged in fisheries as were found here in the British Isles. Perhaps the mention of this fact might lead some people to expect too much from the paper which was about to be read, but as he had said before, Canada was but a young country ; the lecturer could not go back for centuries as Prof. Huxley did in describing the fisheries of the Mediterranean. Their grandsires in the maritime provinces could give almost the whole history of the fisheries of Canada, and they told them how important a part those fisheries played in the settlement of the country. In those days when there were no railways, and no steam boats, supplies of food sometimes failed, but the settler always had something to rely upon in the fish which were to be found in the waters in front of his dwelling. He had heard of a good old clergyman who was greatly shocked at finding one day his little flock fishing on the Sunday, and insisting that the good old practice should be followed, of gathering a double supply of manna on the Saturday. He assumed this cause of complaint did not now exist, for a few weeks before he left Canada he had the pleasure of a conversation with a clergyman visiting Ottawa from Manitoba who told him that he had seen settlers going out in the winter cutting a hole in the ice and dipping fish out in a basket, but he made no mention of any desecration of the Sabbath, so that he assumed there was nothing to complain of in that respect.

FISHERIES OF THE DOMINION OF CANADA.

If ever I have to regret not being familiar with the English language, it is on this particular occasion, when I have been chosen by my brother Commissioners to tell you something of the fisheries of the Dominion of Canada. But my fears are useless. If indulgence is to be met with, it is from a select audience, and I could not wish to come before a more select one than this is.

Being born in Canada, I have for the Dominion that affection that everybody feels for his native country. I have faith in her future.

I would have liked to have shown you how prosperous and flourishing she is beneath the glorious Britannic flag. I would have been proud to trace for you the rapid progress of that colony during the last ten years; but your time is valuable, and some one told me that I was not allowed to keep you here more than half an hour, and half an hour is rather a short time to go over three oceans and a considerable number of inland seas which are themselves small oceans. I will, therefore, confine my remarks to the Canadian fisheries.

In studying the history of England, in looking over the resources whence the greatness of this country—which we are proud to call our mother country—has arisen; we see that her commerce has been the source of that greatness. Furthermore, I may say, without fear of being contradicted, that the fisheries of the United Kingdom have been the basis of this commerce, and that England owes her present naval greatness to the hardy fishermen employed in these fisheries, and the comfort and happiness of whom it is the object of this great International Exhibition to promote.

I have certainly not the intention of comparing Canada to England, but the fisheries of Canada can be compared with advantage to any other fisheries in the world, and I feel proud to be able to state here, that our young colony, following the good example of England, already ranks the fourth amongst the maritime nations of the globe.

When we consider the thousands of miles of coast open to the fishermen of Canada, the 60,000 hardy men who now devote their time and their labour to the development of our fisheries, the millions of dollars which these fisheries produce annually, and the always increasing number of emigrants that the old continent sends us every year, we feel that a naval greatness is also in store for us in the future, and we look to our fisheries, and to our fisheries alone, as the cradle of our future naval strength.

Consequently, the public men of Canada felt a great interest in this international exhibition, and have been glad to take part in it in the hope to acquire an amount of knowledge on fishery matters, which will be of value to our fishermen in developing this great industry.

The honourable gentleman who presides at this meeting, and whom the Canadians have placed at the head of the Department of State devoted to our fisheries, knowing of what vital importance they are to the future of the Dominion, takes a great interest in all matters relating to marine and fisheries, and not only has he recommended the Canadian Parliament to grant as much support as possible for carrying out the objects of this exhibition, but leaving aside, for a while, his important duties as Minister, he has been pleased to come here and see that the Dominion of Canada is thoroughly represented in England.

The Dominion of Canada, bounded on the north by the Arctic Ocean, on the east by the Atlantic, and on the west by the Pacific Ocean, has an area of four millions and five hundred thousand square miles. Over that wide area are found some of the most fertile tracts of land in the world. Grand forests offering an immense field to the timber trade, beds of mineral wealth that but few lands can boast of, and rivers, lakes, and inland seas teeming with apparently unlimited supplies of food fish. The fisherman of any country must feel at home when he comes to a land the waters of which yield him annually a good remuneration for his toilsome and hazardous avocation.

The fisheries of Canada can be divided into two great classes; the sea fisheries, and the fresh water, or lake and river fisheries.

The former are subdivided into the cod fishery, the herring fishery, the mackerel fishery, the lobster fishery, and the seal fishery. The latter comprises the salmon and trout fisheries, the white fish fisheries, etc.

The sea fisheries are carried on specially in what we call the maritime provinces, namely: Nova Scotia, Quebec, New Brunswick, and Prince Edward Island, whilst the provinces of Ontario, Manitoba, and British Columbia are celebrated for their inland fisheries.

In the river and gulf of St. Lawrence alone, Canada possesses more than nine hundred miles of coast, along which are to be found, at different seasons of the year, a greater abundance and variety of fish than in any other part of America.

The shoals of cod-fish, mackerel, herring, etc., which approach our shores for purposes connected with the reproduction of their species are immense, and, I was going to say, inexhaustible.

Of all the fish named above, the cod, the mackerel, the herring, and the lobster, have especially attracted the attention of the fishermen of Canada.

The cod fishery being the most important and the most valuable, the one that gives occupation to the greatest number of men, employs the greatest number of vessels, and produces, commercially speaking, the most advantageous results, I will give it the precedence over the others.

I will direct your attention to the modes of catching and of curing that fish, its yearly value for the Dominion, and the different markets we send it to. The haddock (*Morrhua aeglefinus*) and the hake (*Phycis Americanus*) being taken in the same waters, caught by the same means, and cured the same way as the cod-fish, will be comprised under the title of cod fishery.

The cod is so well-known everywhere that I may dispense with giving any description of it. Let it suffice to say that there are several kinds, of which the only one of any consequence to Canada is the common cod (*Gadus morrhua*) which is found along the coast of the Gulf St. Lawrence.

Speaking of the habits of the cod-fish I cannot do better than to quote here the words of the Honourable Dr. P. Fortin, M.P., now representative of the county of Gaspe, in the House of Commons of Canada, who has been for years commander of the armed schooner "La Canadienne" employed in the protection of our fisheries, and who is considered an authority in this matter.

"The cod inhabits cold and temperate climates. It is found along the coasts of Greenland, Labrador, Newfoundland, Nova Scotia, and the United States. Everybody has heard of the great banks of Newfoundland and of the immense quantity of fish to be found there."

"It abounds on the coasts of Iceland and Norway, visits the coasts of Scotland, England, and Ireland, and is also taken on the coast of France. But it does not appear to go beyond the latitude of Gibraltar, and has not, that I am aware of, been seen in the Mediterranean."

"The cod generally stays in the sea at a depth of from twenty to sixty fathoms, but when the instinct of reproduction is felt it approaches the shores, in pursuit of the caplin, of which it then makes its chief food, and remains six or eight weeks in twelve, eight, and even five fathoms of water. It is then that the taking of this fish can be, and is, most successfully carried on."

"The cod appears on the Canadian coast at uncertain dates, generally between the 10th of May and the 1st of June, though in many instances it has made its appearance in the latter end of the month of April. It has some favourite spots where it is found in greater quantities. These are the places which present the best advantages for the preservation and hatching of the spawn."

"Having deposited its spawn the cod withdraws to the shallow places called banks, where it finds always food in sufficient quantity to satisfy the well-known voracity of its appetite."

Formerly cod were found in great quantities and taken in abundance from Rimouski to St. Anne des Monts in the river St. Lawrence, and as far as New Richmond and even Carleton in the upper part of "La Baie des Chaleurs," but it has now almost entirely disappeared from those places, and fishing in them had to be given up.

About the 15th of December cod-fish appear to leave shallow soundings and the inshore banks, and go farther out to sea.

The season for cod-fishing varies with the different provinces. In Quebec and Nova Scotia it is generally from April to November.

The cod-fishery is carried on in Canada either in vessels of a tonnage of from 60 to 100 tons, or in open boats similar to those that are now exhibited in the Canadian Court.

The fishing in large vessels is carried on principally by the fishermen of Nova Scotia.

Vessels employed in cod fishery are manned by from ten to thirteen men, according to their tonnage. Generally the owner of the schooner, who also supplies the men with all the necessary fishing tackle, receives half of the fish which is caught, the fishermen retaining the other half.

"When the vessels have reached the fishing grounds they are anchored, by hemp or manilla cables, in from fifteen to fifty fathoms of water. Bait is obtained by spreading nets in the sea at some distance from the vessel, and the fishing is then begun with long lines, and carried on, by night as well as by day, in spite of wind and storm, until the hold of the vessel is filled with fish all split and salted. Then the vessel returns to port, the cod is landed, washed, dried and prepared for exportation" (Dr. Fortin).

In the province of Quebec fishermen carry on the cod fishery in open boats, some of them near the coasts in the neighbourhood of the coves and bays where they reside, and some on the banks twenty or thirty miles from the shore.

Those among the fishermen who have the means of doing it, build their own boats, buy their fishing tackles, and have the advantage either of selling their fish fresh in the local markets, or of curing it and getting a better price when it is dried from the speculators who, in the fall, visit every locality along the coast of the Gulf of St. Lawrence, for the purpose of buying cod-fish.

The fisherman who has no boat of his own goes to the capitalist who is engaged in the fishing business. This capitalist furnishes him with a boat all equipped and ready to go to sea, for the sum of five or seven pounds for the fishing season, with the express and written condition that all the fish caught by the fisherman in this boat will be sold to the merchant who furnishes the boat. The boats vary in dimensions, and are from eighteen to thirty feet keel, and their breadth of beam from six to ten feet. They are very sheer built, and the clinker work is usually of cedar. They are built like whale-boats, that is to say, they are pointed at the stem as well as at the stern. Their rigging consists generally of two sprit-sails or gaff-sails; some of those used to fish on the Miscou and other banks are schooner-rigged. They are built by the fishermen themselves, are good sailers, and behave wonderfully well at sea, especially those from Gaspe and Cape Breton.

"The inshore fishing is carried on with hand lines, and the fishermen always set out for the fishing grounds at two or three o'clock in the morning. On arriving at the place where they expect to find fish they cast anchor; then they bait their hooks with fresh fish and drop their lines into the water, each with a leaden sinker attached to it, weighing from two to four pounds according to the depth of the water and the force of the current."

"Each of the two fishermen who man each boat has two lines when fishing in thirty or forty fathoms of water. When the fishing is in ten fathoms, or less, they use four lines each. If there are plenty of fish, as it is often the case in the spring, the fisherman has not a moment's rest, when once he has begun; for while he is hauling up one line the other is going down and before he has unhooked one fish from the former another fish is fast to the latter. The lines are always furnished with two hooks and oftentimes they come up with a fish on each hook; the fishermen calls this "taking a pair."

"Sometimes there is no good fishing at the first anchorage; in that case the anchor is weighed and the boat is sailed away in search of a better place. When the fish is plentiful it is not an uncommon case to see the boats coming ashore in the afternoon with 2000 pounds of fish, that is 1000 for each man."

"The fishermen generally remain on the fishing grounds until four or five o'clock in the afternoon, after which they hasten ashore in order that the cod they bring may be split and salted immediately, before it has time to heat or soften" (Dr. Fortin).

The bank fishing is made with long lines which our fishermen call "Norman lines." These lines consist of a long and strong line of from 600 to 1200 fathoms with hooks fastened along its whole length at regular distances by shorter and smaller lines, called snoods. The snoods are three feet long and are placed on the long line six feet apart to prevent the hooks becoming entangled. At each end of the long line is an anchor, a buoy line and a buoy, and the line is always laid across the tide; for if the tide runs upon the end of the line, the hooks will become entangled and the fishing would be totally lost.

On getting to the bank or fishing-ground, the hooks being previously baited and the line neatly coiled in tubs, clear for running out, one of the two fishermen who are manning the boat sinks the line whilst the other is steering the boat.

The line remains in the water from six to eight hours, according to the time when sunk and also to other circumstances, after which time it is hauled in. In certain seasons of the year, especially in the month of September, two fishermen in a few hours, with a line of 800 fathoms, will take five or six thousand pounds of fish.

From the 15th of June to the 15th of October, two men carrying on the bank fishing actively can easily take 600 quintals of cod-fish. The average quantity caught by each boat is about 400 quintals, each quintal being worth six shillings in the local markets.

"The months of June, July and August are the most favourable for the cod fishery; not only because during that period, the air is frequently calm, there are long spells of fine weather, and storms are more rare than at any other time during the season, but also because it is then that the cod-fish resorts more to the coast either to spawn or in pursuit of the caplin or sable launce, on which it feeds, and because these fish, which serve as bait, are then more abundant and easier to take; for it must be remembered that there is no good fishing without fresh bait. The cod is not at all partial to salt-fish, and it is only on the great banks where the cod feeds chiefly on crustacea and mollusca that it bites at a line baited with salt herring or salt caplin."

"It is therefore most essential for the fishermen to be always provided with fresh fish for bait, and they accordingly have herring, caplin and launce seines which they make use of every morning and every evening, to provide themselves with a sufficient quantity of little fish for the day" (Dr. Fortin).

On every large fishing establishment, from the end of May to the beginning of August two or three boats, each of them manned by seven men called seiners, are employed day and night in going about the coast in search of the caplin, herring and launce. Sometimes they have to go 20 and 25 miles from the establishment. When they meet with a shoal of these fish, they cast the seine, load their boat and hasten home to distribute these little fish amongst the fishermen belonging to the same establishment. Each cod-fishing boat receives an equal share of the fish thus brought by the seiner.

When the caplin and sand launce have disappeared from the coast, or do not come near enough to the beach to be taken by the seine, the fishermen have to go out every evening and take herring and mackerel in drift-nets; or squid and other fish with hooks and lines.

Late in the fall, the only fish that can be taken for bait is the smelt.

The fishing from the beginning of the season to the fifteenth of August is called the summer-fishing; what is carried on after that date is called the autumn-fishing. All the cod taken until the end of September is salted and dried to be exported to foreign countries; what is taken from the first of October to the end of the fishing season is salted and packed in barrels and sent to the local markets.

FISH CURING.

Great care and attention as well as labour are required in the preparation of cod fish for foreign countries. Before explaining the mode in which cod fish is prepared, you will allow me to give a short description of what constitutes a fish-curing establishment.

Anybody wanting further explanation on this subject can come into the Canadian Court, where six models of the most important fishing establishments of the world are exhibited, and he will receive all possible information.

A fishing establishment generally constitutes a small village by itself. On some of them the visitor can count no less than one hundred and twenty buildings. It is a collection or an agglomeration of wooden buildings, some of which serve to lodge the fishermen and other *employés* of the establishment, and others to receive the fish, either in its fresh or dried state, and to contain goods, the rigging of fishing vessels and boats, provisions, salt, &c.

An enumeration of some of these buildings with the name of each of them, will give you an idea of the importance and extent of these establishments.

There is first the house of the chief of the establishment, then the stage, the dried fish stores, the steam house, the goods shop, the flour and provision store, the rope and paint store, the pitch store, the salt store, the coal oil store, the wharf house, the carpenters' shop, the block shop, the coopers' shop, the iron and stores store, the forge, the rigging loft, the sale loft, the joiners' shop, the mould loft, the cook-house, the mechanics' cook-room, the shoremen work-shop, the fishermen cook-room, the shoremen cook-room, the ice house, the telegraph-office, the hospital, &c.

The house of the chief of the establishment is placed in the centre of the group of buildings, and in an elevated position, from which he can see all that goes on.

"The stage, which is the most important building in a cod-fish curing establishment, is placed as near as possible to the beach. Some establishments have four or five stages. They are large wooden buildings measuring generally eighty feet by fifty, at one end of which is a wharf called the stage-head, extending far enough into the sea for boats loaded with fish to come alongside of it at low tide. The flooring of the wharf, formed of poles of fir or spruce, is divided into compartments, into which the fishermen, on their arrival, with boat loads of fish, toss them one by one with an implement called a pur."

"At the end of the stage nearest to the wharf are the tables on which the cod is dressed. In the middle is a passage with a level floor of strong planks, on which the shoremen can wheel with ease their barrow loads of salt or fresh fish. On each side are places for piles of fish, for salt and for troughs to wash the fish in."

"In the Canadian establishments three men are employed in the operation of dressing cod, namely, the cut throat, the header and the splitter."

"As soon as the cod has been landed on the stage, and put on the tables, the cut throat, armed with a two-edged knife, seizes the fish, cuts its throat, and having opened it down to the navel with a single stroke of his knife, passes it to the header. The header detaches the liver, which he throws into a barrel placed near him, and with the same hand tears out the entrails, after which with his left hand he cuts off the fish's head. The splitter now seizes the fish, and with a single stroke of his knife he removes the back bone" (Dr. Fortin).

From the back bone of the fish is taken that delicious article of food which is well known as cod-fish sounds. These sounds are either salted, and packed in barrels and sold in the local markets, or dried and sold to isinglass manufacturers.

The head of the cod is salted for local consumption; but I regret to say that thousands of tons of entrails, offals, and even cod-roes are yearly thrown into the sea and wasted, whilst they could be converted into a good guano, if we had manufacturers of this article on our coasts.

"From the hands of the splitter the cod passes into those of the salter, who places it on a pile, spreading it carefully with the flesh up, and with a wooden shovel scatters a layer of salt over each row. The salter's art lies in putting on each fish just salt enough to make it keep well, but not enough to burn it."

"The cod is left piled in this way for four, six or eight days, according to the quality of the salt. Then the fish is carefully washed in large troughs, until all the salt is washed off, when it is put in piles again on the stage, in order that the moisture may drain off from it. After a day or two, if the weather is favourable, the fish are spread out one by one on flakes, in order that by exposure to the action of the sun and air they may be deprived of all the water they contain, and be reduced to that dry state in which they may be preserved for several years even in hot climates."

The small fish is put on flakes about three feet high, parallel to each other, with space of four feet between, to enable the men in charge of the fish to move round them.

The large size fish, containing more water, being thicker, and consequently more difficult to dry, is placed upon large flakes, one hundred feet square or more, ten feet from the ground and as much as possible built along the beach, where the heat of the sun is always tempered with a gentle breeze from the sea.

The first night after the fish have been put out, they are merely turned over flesh side down; after that they are gathered every night into piles of twenty or thirty each, and every morning they are spread out with the flesh up.

When sometimes about the middle of the day the sun gets too hot, the flakes, that are fixed on a pivot, are turned to prevent the fish from being burnt, or the fish is covered with small fir and spruce branches.

When there is a large quantity of fish on the flakes, the man who, in each establishment, has the superintendence of the operations of curing the fish, must be always on the look out, watching the sky and looking to every part of the horizon to see if clouds that threaten rain are gathering. At the least appearance of rain, or of a shower, orders are given to gather up the fish. The scene, then, is lively. The chief agent, book-keepers, clerks, carpenters, blacksmiths, everybody in the establishment goes to work, and when they have done, each goes back to his own business, satisfied and free from anxiety, for the cod, when placed in piles with its skin up, cannot suffer from the rain, unless the wet weather last very long.

"When the cod is sufficiently dry, large round piles of it are made, containing as much as 100 quintals each, covered with birch bark, and pressed with heavy stones. By the pressure of these stones it is deprived of the little moisture that remained in it. Before it is sent to market it is spread out again on the ground, covered with fine gravel, during the warm hours of one fine day to give it its 'last sunning' or 'parting-sun.'"

"In fine weather and during the dry season, when westerly winds predominate, cod is easily cured and made of the first quality. It is not so when easterly winds prevail and bring upon our coast mist and rain that lasts for weeks; our fishermen are then in the greatest state of anxiety, and in spite of every possible care and precaution they frequently see the fish which it has cost them so much toil and exposure to danger to snatch from the sea, spoiled before their eyes, without its being in their power, by any means whatever, to obviate the destructive effect of the dampness; for once the fish has been exposed upon the flakes, it cannot be taken in the stores until it is perfectly dry."

It is, I think, on the coast of Gaspe, in the province of Quebec, where the effects of the mists, generated by the Gulf Stream are least felt, that the finest cod in all America is cured. This is well known in the markets of Spain, Italy and Brazil where it is generally sent. Specimens of it can be seen in the Canadian Department of this Exhibition.

In order to guard against all risks from the weather, attempts have been made to dry cod artificially, but so far it has not succeeded as well as was expected, and I am of opinion that the agency of the sun and air are the best that can be employed for the drying of cod-fish.

VALUE OF THE COD FISHERY, AND MARKETS WHENCE OUR COD-FISH IS SENT.

When the cod-fish is dry enough to be sent to market as stated above, it is carefully culled. Three qualities of it are made, the marketable, the inferior, and the "refused," that is, the heavy salted and broken fish.

The large marketable is sent in bulk in vessels, varying in dimensions from 100 to 300 tons, to Spain, Italy, Portugal, and the Mediterranean ports; the small marketable is generally sent to Brazil in drums, containing 128 pounds, and the last quality is sent to the West Indies markets in casks containing 500 pounds.

By the Report of Marine and Fisheries of Canada for 1881 we see that the quantity of dry fish exported that year is 1,299,340 quintals, representing a value of 5,602,250 dollars.

Besides the cod-fish, there are 245,453 pounds of cod and hake sounds, and 333,310 gallons of cod oil, representing a value of 225,906 dollars. Total of exports from cod fishery 5,828,156 dollars. If to that sum we add the value of pickled fish sent to local markets and used in home consumption, we will have a grand total of sixteen million and a half dollars.

Nothing more eloquent than a figure, somebody has said, and the above statement can give an idea of the importance of the cod fishery in Canada. It is undoubtedly one of our most important branches of industry, and one that gives rise to a considerable commerce.

I regret to say here that none, I may say, of our Canadian business men, have yet determined upon carrying on the cod fishery, and an export trade of cod-fish on a large scale. And yet nowhere in all America is there a greater abundance of fish of all kinds than on the coast of Canada.

What then has kept this industry from developing itself more widely in the Dominion ? Many causes.

First of all, the want of capital, then the want of practical knowledge of the importance of the Canadian fisheries and of the precious resources they offer, and also, perhaps, the total absence, until these last years, of communication, during winter, between the central part of Canada and the principal ports of the Gulf St. Lawrence.

Some of these causes exist no longer. The Intercolonial Railway now connects the fisheries settlements of Nova Scotia, New Brunswick and Quebec with all parts of Canada, and capital, although not over abundant, is certainly not wanting.

The largest establishments in which the fisheries are carried on in Canada were founded 120 years ago by an enterprising Jerseyman. His means were then limited, he could not control a large capital, but the accumulated profits of the Canadian fisheries have enriched him and his children. They are now worth many millions, and have almost a monopoly of the gulf fishery trade. Who, having anything to do with fish and fisheries and all that belongs to such industries, has not heard of the wealthy firm of Charles Robin & Co.? Besides Charles Robin & Co., there are also in Nova Scotia, New Brunswick and Quebec, many other firms engaged in the fishing business, and who, though on a smaller scale, are nevertheless doing large business. I may mention, D. Cronan, Brennan & Hart, H. Jones, from Halifax; Le Bouthiller & Bros., J. & E. Collas, J. Le Bouthiller & Co., Valpy & Le Bas, from Gaspe.

Of late a few other establishments have been started, but they are on a small scale. There is room for many more, and I hope that a new era in the history of the Canadian fisheries is at hand. I hope that this great International Exhibition will be for Canada fruitful in happy results, by making known the great commercial importance and the immense value of its fisheries, and will engage capitalists of this and other countries to invest in their profitable prosecution. The sea fishery next in importance to the cod fishery in Canada is the

HERRING FISHERY,

the value of which, according to our last statistics, was 1,721,822 dollars.

The herring arrives in the Canadian waters early in the spring, and as soon as the ice has disappeared from our coasts. From the month of April to the month of December it is seen in immense shoals on the Atlantic Coast of Nova Scotia, in the Gulf St. Lawrence, in the Gulf of Canso, in the numerous coves and bays formed by the Magdelen Islands, and in the Baie des Chaleurs.

In winter it disappears from our northern coasts, though a considerable quantity is taken during that time along the southern coast of New Brunswick.

In many of our bays, in the spring, the herring sometimes appear in such dense shoals near the shore, that the pressure upon each other, increased by the force of the tide, kills them by thousands.

" It is impossible without seeing," writes Dr. Fortin, " to form a correct idea of the prodigious abundance of the ova of the herring deposited on all the coast where the herring spawns. I have seen, in many instances, the shore covered two or three feet deep with them for several miles. This will, perhaps, appear astonishing to some persons; but they will soon recover from their astonishment when they reflect upon the fact that the female herring has from six to eight millions of ova in its ovaries.

" Providence has no doubt ordained that there should be this prodigious quantity of ova, in order that there should remain enough for the preservation of the species in the numerical proportion required by the Creator, notwithstanding a loss of a great portion of them which are washed on shore by the waves, or are devoured by the little fishes.

" As might naturally be expected, the appearance of the herring along our coast does not fail to engage the attention of our fishermen, for whom its capture is a highly profitable employment."

" No sooner in the spring has the first shoal of herrings been observed at any place along the coast, than all the fishermen in the neighbourhood repair to the beach with their nets, their lines, and all their other fishing tackle. Soon a great number of boats are plying in every direction about the bays and coves where the fish are expected. These boats contain the fishermen who go to spread their nets so as to intercept the shoals of herring, when seeking to approach the shore at night for the purpose of spawning.

The nets used by our fishermen are generally thirty fathoms long by five or six wide."

They are set in the evening, and in the morning early the fishermen visit them, take out the fish, and if necessary take the net ashore to clean it. Generally, in the spring, when the fishing is good, each net will take from five to ten barrels of fish during one night.

But there is a much more expeditious mode of taking herrings than with nets, and that is with seines. Seines for this purpose must be of large dimensions, say from one hundred to one hundred and fifty fathoms long, by from eight to eleven fathoms wide, with braces of two hundred fathoms long. These seines are expensive and require many hands to work them, so that it is not every fishermen that can have one. There are also the purse seines which are used to fish the herrings on the banks, sometimes twenty and thirty miles from the shore.

Seine-fishing for herrings is chiefly carried on by fishermen of Nova Scotia, in schooners of the same tonnage as those employed in the cod fishery.

Those who fish with nets, when once they have set them in places where they think the greater number of fish will pass, wait for the fish to come in and get entangled. Those who fish with seines, on the contrary, go out in search of the fish along the coasts they expect them to approach, with the seine in a large boat, manned by eight men. A score of seamen, in smaller boats, precede and follow the seine boat and look out in every direction for signs of the presence of shoals of herrings. If the surface of the water is agitated at any particular spot, they immediately proceed there. Their cruises are frequently unsuccessful. Sometimes they row for whole days without seeing a single fish ; but they have also their strokes of good fortune, and fishermen with seines of large dimensions often take at a single haul of the seine herrings enough to fill 500, 1000, 2000 or even 3000 barrels. One need not be surprised at such great results when one reflects that herrings in a shoal are so crowded together as to almost form a compact mass from the surface of the water to the bottom.

When the seine is so much loaded with fish it cannot be hauled on shore without risk of breaking it and losing the riches it contains, the braces are made fast on shore and the fishermen seine with small seines inside of the large one; or if the fish are very thick, they are taken out with scoop nets or landing nets.

If the weather is calm or the wind off the land, the seine may be left moored in this way for several days or until all the fish have been taken out of it, but if, unfortunately, a sea breeze springs up and it begins to blow hard, the seine must be taken up at once or it will be torn to pieces by the violence of the waves. Many thousands of barrels of fish are lost in this way.

Herrings are salted either round or split and packed in barrels, containing 200 pounds, to be sent to the United States and West Indies markets. Only a small quantity is sent to the English markets.

They are of different qualities; those caught from August to October being far superior to the spring herring, and the best of all being the celebrated and well known "Labrador herrings."

MACKEREL FISHERY.

The mackerel is one of the most valuable of all the fish that visits the Canadian coast. Unfortunately, it is only these last years that this fish has been appreciated at its real value by the Canadian fishermen.

During many years the important mackerel fishery in the Gulf St. Lawrence was almost entirely left in the hands of our American neighbours.

Even now, I am sorry to say, there is not in the whole province of Quebec, where this fish is in great abundance, one single schooner specially employed in this fishery. The fishermen of this province generally contenting themselves with taking mackerel for home consumption, or for bait for the cod-fishery.

The fishermen of Nova Scotia, New Brunswick and Prince Edward Island understand their interests better, and they have, every season, prosecuting the mackerel fishery, a fleet of fine vessels, so improved in symmetry as to bear fair comparison with the American mackerel schooners, which are reputed to be the finest vessels, and the best sailers of their class in the world.

These schooners are usually of from 60 to 100 tons. They have little depth of hold, great breadth of beam, take very much fore and aft, and carry large cotton sails, which enable them to sail fast, even with a light breeze. They are met with everywhere in the southern part of the Gulf St. Lawrence, during the months of July, August and September ; and from a distance look more like a small squadron of yachts than a fleet of fishing vessels, so beautiful are their masts and sails, and so neat and clean are they kept.

But on a nearer approach this is found to be an error, for on the decks of these vessels are to be seen crews of ten or twenty men all occupied either in catching fish, in repairing fishing implements, or in splitting and salting the fish that have been taken ; and what is more striking is the order that reigns on board of these schooners.

The mackerel fishing is carried on in two ways, with the seine and with hooks and lines.

The mode of seining I have already described in speaking of the herring fishery. Dr. Fortin will tell us how the hook and line fishing is done.

"Before sailing from their port of outfit for the Gulf St. Lawrence, the fishermen provide themselves with several barrels of very fat little fish called "poggies," to serve as bait and as food for the purpose of attracting the mackerel to the surface of the water. At a later period, when the "poggies" are exhausted, recourse is had to the offal of the mackerel for bait, and it is prepared in this way:—whole fishes or the offal of fishes, either "poggies," mackerel or others, are chopped up very fine in a machine something like a straw cutter, and then put into a large bucket full of salt water; the mixture is then stirred for a long time with a small paddle.

"As soon as the schooners have reached the places where shoals of mackerel are to be found, they keep cruising backwards and forwards, and the moment there is the least appearance of fish near a vessel, the jibs are taken in and the vessel is brought to with the mizen sail and main sail veered half round. Feed is then scattered all around, the fishermen seize their lines, bait their hooks with small pieces of the skin of the neck of the mackerel or any other fish and throw them into the water. The lines are fine and made of hemp or cotton, generally the latter; they are from six to eight fathoms long and to the end is fastened a small sinker of polished pewter, oblong in shape and weighing about two ounces, to one end of which is soldered a middle sized hook." (Dr. Fortin.)

Each fisherman plies two lines, one in each hand and leans on the rail of the schooner while fishing. He very seldom pays out more than four or five fathoms of line, for the mackerel attracted by the chopped fish thrown overboard, rise to the surface.

From fifty to thirty barrels of mackerel may be taken in six hours by a crew of fifteen men.

The mackerel fishery is difficult and therefore requires to be carried on with sagacity and perseverance, but it is generally successful, brings in large profits, and is certainly worthy of the attention of capitalists.

Like the herrings, the mackerel are salted, and packed into barrels of 200 pounds and sent to the English, United States of America, and West Indies markets. Some are preserved in cans and some are also sent to the markets in a fresh state.

Over 74,900 barrels of pickled mackerel and 394,489 cans of the same fish have been exported from Canada last year. If we add to that, 131,000 barrels and 283,000 cans which have been sent to the local markets and what is used in home consumption, and we will have a total value of 1,694,942 dollars for the mackerel fishery.

The mention of canned mackerel brings me to speak of another important branch of the Canadian sea fisheries, one that is increasing every year, and that gives remunerative employment to a large part of our population. I mean the

LOBSTER FISHERY.

This industry has but lately assumed a commercial importance in our country.

Ten years ago the lobster fishery was almost unknown in Canada, and carried on merely in the provinces of Nova Scotia and New Brunswick.

In 1873 these two last provinces had sixty-four factories in operation for the preparation and canning of the lobsters, and during a period of ten years no less than four hundred of these establishments have been built and are now in full operation.

The province of Prince Edward Island, where this industry was unknown in 1873, possesses to-day 118 factories, which last year sent out to different markets three millions and a quarter cans.

A large amount of ready money is circulated in Canada by this industry. Besides the erection and repairs of buildings, tin and iron work, boat-building, fuel-cutting, truckage, and other expenditure, fair wages are paid, directly or indirectly, to thousands of hands, male and female. Hence the industry is of considerable importance in the general economy of the Dominion.

According to the Fisheries Statement of 1882 the lobster fishery of Canada has yielded seventeen millions and a half cans, representing a commercial value of nearly three million dollars.

These figures not only indicate the extent of the interests connected with this branch of industry, but also suggest the danger of over-production, both of which facts point to the necessity for economising and perpetuating the natural supply.

There is nothing easier than to exhaust a shell-fishery, but also nothing harder than to revive it, and the Government of the Dominion, alive to this fact, is taking measures to prevent any indiscriminate fishing of the lobster on our coast.

Doubtless, if the fishing that is now carried on was not subjected to strict regulations, all persons interested in it would prosper for a short time, and the country would appear to benefit by the rapid and extensive development of this resource, but a period of reaction would necessarily ensue. Consequently, if we wish to perpetuate such a valuable possession, it is wiser to economise it in time, than to be obliged, later on, to make extreme and costly endeavours to arrest its decline, or to restore it from complete exhaustion.

SEAL FISHERY.

The herds of seal that frequent the Gulf St. Lawrence and the Atlantic arrive there in the month of November. They come chiefly into the gulf through the Strait of Belleisle. They keep very close to the coast of Labrador and Newfoundland, penetrating into all the bays, and not going far out from land when doubling the points and capes. They are fond of approaching the shore and landing on sandy beaches or flat rocks to bask in the sun; but at the slightest noise, and especially if they perceive the fishermen, they make for the sea and disappear under its water.

Seals are of great value, not only on account of the thick layer of fat between their skin and their muscles, which yields an oil superior to that of the whale, but also on account of their skin, which tans well and makes an excellent leather.

The importance in a commercial point of view was soon perceived by the first mariners who visited the Gulf St. Lawrence, for no sooner was Canada discovered, than the seal fishery was prosecuted on our coasts, and if we are to believe the accounts which have come down to us, in manuscript and by tradition, of several voyages to the coast of Labrador during the last century, immense numbers of them were taken at that period. Then, as now, nets were used for the purpose of capturing these marine animals.

These nets are made of a hempen cord, which is very strong, although not more than the twelfth part of an inch thick. The meshes are eight inches square and will admit the head and neck of the seal. Some of these nets are more than six hundred feet long by sixty feet wide.

The usual time for the seals to pass near the shore on their migratory voyage being known, the nets are set a few days before. One of the fisherman is posted as a sentry on a rock, a little in advance of the fishery, to give notice of the approach of herds of seals, and the moment that any appear in the fishery, the signal is given, and the fishermen hasten to raise by means of a capstan, a net sunk by leaden weights, to the bottom of the water, at the entrance of the fishery. With this net they close the opening through which the seals made their ingress; and as soon as this operation is completed, and the seals are fairly imprisoned, the fishermen jump into their boats and enter the fishery shouting and beating the water with their paddles. The frightened seals, trying to escape, dive down and run their heads into the meshes of the nets, which are kept always open by means of cables round the borders of the nets.

As soon as the seals are caught in the meshes, the men under-run the nets, knock on the head those that are not strangled and carry them all on shore in their canoes.

The autumn seal fishing takes place on the coast of Labrador, at the end of November, and in December, and is very arduous by reason of the severity of the cold at that season.

The seals are no sooner taken out of the water than they become frozen; and in that state they are put into stores and it is not until the spring, when the warm rain has softened them, that they are cut up and their fat melted.

Seals are not only taken in nets near the shore, in the manner I have just described, but they are also pursued in every direction, and are sought for on the ice-fields, not only in the Gulf of St. Lawrence, but also in the North Atlantic Ocean.

The expeditions that are fitted for this latter kind of fishing, or rather of hunting, require to start early in the spring, in order to find the seals on the ice-fields; for, once they are in the water, they can set the most experienced men at defiance, and it is useless to pursue them.

Large capital is invested in the seal fishery, especially in Newfoundland. In the Dominion, so far, this fishery has not been carried on on a very large scale, it being limited to Magdalen Islands and Labrador.

It has produced last year 75,242 seals, and 220,157 [??] of oil; the whole worth 332,521 dollars.

The Government of Canada, in order to develop our vast maritime resources, has spent about five millions of dollars to improve and render secure harbours along our coasts, and to establish telegraphic communication between the fishing districts of the Dominion.

The area covered by this telegraphic system, that we owe to the energetic efforts of Dr. P. Fortin, is about 27,000 square miles of our most prolific fishing grounds.

All our fisheries stations are connected by it, and every day at the different telegraph offices, bulletins are displayed and distributed, indicating the probability of the weather for the coming twenty-four hours, the existence of bait in particular localities, the whereabouts of fish, &c.

This telegraphic system, which is illustrated by the maps and blank of bulletin issued by the Department of Public Works of the Dominion, and which can be obtained at the Canadian Court of this Exhibition, has not only proved of great value to our fisheries, and afforded great encouragement to capitalists and fishermen engaged in them, but also contributes largely to render safer the navigation of the River and Gulf St. Lawrence, to guide the vessels out of danger, to reduce the rate of insurance, and to encourage the shipping trade.

Mr. W. F. Witcher, Commissioner of Fisheries for Canada, being requested to give his opinion on the advisability of establishing telegraphic communications along our coasts, writes in 1876:

"The pursuit of an industry such as that of fishing within nine hundred miles of coast is necessarily attended by many dangers and peculiar drawbacks."

"Exposure of life and property is frequent. Success depends very much on the seasons. Many kinds of fish of erratic habits are eccentric in their movements. Plenty and scarcity may alternate in places, from which the settlers depending wholly on any fishery have no escape. Within twenty miles of settlement, on a barren and uninhabited coast, the fish may strike and remain without any possibility of their whereabouts being known at other places; they may be abundant beyond the capacity of shoremen or vessels to catch them, and yet fishermen not far distant may be unable to procure even sufficient for their winter supply. Vessels may return empty in one season from fishing grounds where previously or afterwards the fish abound. Some may lose the greater and best part of each season in searching after the shoals. Still the waters teem with fish, and sooner or later they approach the shore, or frequent the shallows. It seems possible for the spirit of modern improvement to devise some means of providing against these vicissitudes. That plan which strikes me as the most feasible is a telegraphic system, connecting together the main fishing stations. The idea of signal stations, from which to observe and notify movements of fish, has been carried out to some extent in Norway, Holland, Germany, Sicily, and on the coast of Cornwall. It has proved of material assistance to the fishermen, and aided considerably in developing the fisheries of each of these countries."

"There is no doubt it would prove advantageous to Canadian fishermen. Besides affording greater inducement and security to employers of capital, and inspiring confidence in those exposed to danger and hardships, it would undoubtedly enable us to increase production and enlarge our exports."

Besides the money spent in the two great services above mentioned, our Government distributes yearly a sum of one hundred and fifty thousand dollars as a bounty to our fishermen and owners of vessels and boats.

The short time I have at my disposal does not permit me to speak of other sea fisheries, such as the oyster, the halibut, the whale fisheries, etc., which, though not possessing such a great commercial value as the cod and other fisheries, are not, nevertheless, without importance.

I will now draw your attention to our freshwater fisheries.

FRESHWATER FISHERIES.

Honour to whom honour is due. I will first speak of the salmon, which is justly styled the king of our freshwater fish.

When Canada was first settled our rivers were celebrated for the number of salmon that were taken in them.

Afterwards, the rivers ceased to be so well stocked with fish in consequence of too many being taken at all seasons of the year, and of the want of laws and regulations for their preservation. But within the last few years, there has been a great change; good laws and judicious regulations limit the fishing to certain seasons of the year, and prescribe the kinds and number of fishing implements that may be used. Officers have been appointed to enforce the law; the coasts and rivers are well protected; from the eleven fish-breeding establishments which are under the control of the Government, millions of young salmon are distributed yearly in our rivers, and we have every cause to hope that in a few years our rivers will be replenished, and we shall be again able to procure and to send to foreign markets, at moderate prices, this delicious fish which ranks so highly amongst the luxuries of the table. This view is fully borne out by the official returns of our inspectors of fisheries, and overseers, whose returns for the year 1882 give a most satisfactory account of the greatly increased number of salmon in the rivers and coast fisheries of the Dominion. Specially is this noticed in the rivers where young fry have been distributed from the hatcheries. I am happy to say that letters addressed to me from Canada, last week, state that the catch of salmon this season will be, according to all appearances, much superior again.

Although the salmon fishery has somewhat decreased in abundance in Canada during the last few years, it has yet, nevertheless, a considerable importance, and is a source of wealth for many of the inhabitants of the Dominion, besides being a source of pleasure for a great number of wealthy gentlemen from England, United States of America and other countries, who every summer visit our rivers to enjoy the salmon fly-fishing.

Who amongst those anglers does not know, or at least has not heard of, the far-famed Ristigouche, Cascapidiac, Gaspe, and other Canadian rivers?

To prove the importance of our salmon fishery I cannot do better than again consult the reports of our statisticians.

I find in the last statistics we have on this subject, that the salmon fishery produced in the year 1881: 6,038 barrels of salted salmon; 2,614,446 pounds of the same fish fresh and smoked, and 8,500,000 pounds preserved in cans; total 12,322,046 pounds.

Supposing for every fish taken an average weight of 15 pounds, we shall have in 1881 821,469 salmon caught in the Canadian waters. And the returns for the season 1882 will certainly show an increase on the above catch.

The Province of British Columbia alone, the factories of which have preserved in 1881 8,000,000 of pounds, will send to the markets this year 12,000,000 of cans. And yet, Mr. Anderson, Inspector of Fisheries for this Province says in his report, dated 1st January, 1882, that the canneries of British Columbia, notwithstanding the abundance of fish, could not be worked up to their full capacity, owing to the deficiency of labour, arising from the increased demand for railways and other purposes.

Most of the Canadian salmon is caught along the shores of the Gulf of St. Lawrence and near the estuaries of the rivers where this fish goes for the purpose of spawning, and in the rivers of British Columbia.

Some of our pickled salmon reach the British market, but it is chiefly the salmon preserved in cans that we send there.

So far, almost all the fresh Canadian salmon has been sent to the United States markets; but attempts have been successfully made to send it to the English markets; and I hope that after this Exhibition a much greater quantity of it will be exported there.

TROUT, WHITE FISH, &c.

All the Canadian rivers abound with trout of all kinds, of which the best are the sea trout and the salmon-trout. But it is chiefly in the lakes of the Province of Ontario that the white fish and trout fisheries are carried on on a large scale.

These lakes, which I have called inland seas, are perhaps the largest bodies of fresh water in the world.

Lake Superior alone covers an area of thirty-one thousand square miles, while Lakes Erie, Huron, and Ontario, put together, have an expanse of fifty-two thousand square miles.

The numerous rivers that empty their waters into these lakes, as well as the lakes themselves, teem with an abundance of different kinds of food fishes, which are well known for their flavour and their delicacy; and the fishermen of Ontario can choose between the salmon-trout, weighing as much as eighty pounds, the white fish, which is equal in flavour to the salmon itself, and the sturgeon, the pickerel, the pike, the bass, the sunfish, &c., &c.

Fishing in the Canadian lakes is carried on with gill nets and trap nets, and the vessels used are either sailing-boats, varying in dimensions from twenty to thirty feet, or small steamers which are called fishing-tugs.

These small steamers—two models of which can be seen in the Canadian Court—are fifty feet long, and twelve feet beam. They are generally owned by fish merchants, who engage men to carry on the fishing for them. These fishermen are on wages, and do not share in the profits of the catch; but if the fishing is successful, they sometimes receive a bonus from the proprietor of the steamer.

These fishing steamers have a great advantage over the sailing-boats. While half the crew who man them is occupied in taking in the nets that have been set the day previous, the other half is setting out clean nets, and as soon as these two operations are finished, the steamer hastens to the nearest railway-station, and the fish which have just been caught, is immediately sent, in a fresh state, in ice, some to the Canadian cities and some to the United States markets.

The produce of the lakes fishery last year was 4,500,000 pounds of white fish sent fresh to the markets, 5,079 barrels of the same fish salted, 9,758 barrels of trout and 41,360 barrels of sturgeon, bass, pike, maskinonge and other fishes ; total, 56,000 barrels and 4,500,000 pounds.

And yet the population of the Province of Ontario being chiefly composed of farmers, only a small capital is invested in the lakes fisheries. I have no doubt that the amount of fish now taken could be annually doubled and even trebled if a larger number of men were employed in the development of this industry.

I have not said anything either of the smelt fishery, which in New Brunswick and Nova Scotia gives employment, during the winter months, to many hundreds of the inhabitants of those two provinces, and by which fishermen can make from $200 to $300 a day, or of the eel, the bar, the sturgeon and many other freshwater fisheries. I may perhaps have another opportunity to tell you of the extent and value of these. It will suffice to say that the export of the freshwater fisheries of the Dominion, although sold at a low figure, produced last year the sum of 3,174,533 dollars.

Statistical reports do not give with any pretence to accuracy the value of home consumption, but, as fish in Canada is a very cheap article of food, it is largely used in every family.

His Royal Highness the Duke of Edinburgh in the valuable and interesting papers that he has written on the British fisheries states that "the total quantity of fish brought to London in a year, represents a consumption of 67 pounds per head of the population of the Metropolis."

If in London, where the price of fish is equal to and even higher than meat, such a quantity is consumed yearly, I may say that in Canada, where fish can be obtained at a merely nominal figure, the above quantity is almost doubled, and it is safe to say that 450,000,000 pounds of fish, or 100 pounds per head, is yearly consumed by the Canadian population ; which, at three cents or two pence a pound, gives a sum of thirteen million and a half dollars.

Adding to these thirteen million and a half the amount of the exports, we have as the yearly value of the Canadian fisheries a grand total of twenty-seven million dollars, or over five million and a half pounds sterling.

The above figures speak for themselves, and show the richness of the Canadian waters. As I have already said the sea fisheries of Canada require nothing else than capital to be more remunerative than they actually are.

Many of the numerous practical men who are daily visiting this Exhibition ask the following questions—

How is it that so little of your fish reaches the British markets? Why do you not send us your dry and boneless cod, your pickled and fresh fish, etc.

To this we may answer: 1. Canada is sending here a good quantity of salmon, lobsters and mackerel preserved in tins; 2. One cargo of fresh salmon, was some years ago sent to this market from Canada, and I have reason to believe that the same dealer, satisfied with the practicability of the trade, will make a further shipment this season; 3. I sincerely hope that this great International Fisheries

Exhibition will have the effect of making our dry and pickled fish better known and better appreciated, and that a much larger trade, beneficial to both countries, will be, hereafter, carried on between Canada and the Mother Country.

Before concluding these remarks, you will allow me to say a few words of the laws and regulations protecting our fisheries.

First, are fisheries exhaustible, and consequently, is there any necessity for their protection?

This question the eminent Professor Huxley, in his valuable address, at the opening of these conferences, has answered to a certain degree.

It seems admitted by everybody that the freshwater fisheries can easily be exhausted by indiscriminate fishing.

As to some of the sea fisheries, namely: cod, herring and mackerel fisheries, &c., opinions differ, and though, considering the immense power of reproduction that Providence has given to the above named fishes, I would feel inclined to think with some scientists, that it is impossible to exhaust the *deep sea fisheries*, whilst upon their feeding grounds, there are nevertheless facts leading to conclude that *deep sea fishes* should be protected specially when they come near to the coast for the purpose of spawning.

So far, every one of the learned gentlemen who have come here to speak on the British fisheries, has stated that English fishermen having to go farther out to sea, consequently have to incur more expenses and are exposed to greater dangers in order to provide the markets with fish.

If I am allowed to add to what these gentlemen have said of the British fisheries, the experience that twenty-five years' observation on the coast of the Gulf of St. Lawrence, where our largest sea fisheries are carried on, has given me, I will say that there is certainly, owing to an indiscriminate fishing in the time they are spawning, a decrease of our sea fishes about the coasts of Canada.

For instance, in the River St. Lawrence, from Rimouski to Cap Chat, and in the upper end of the Baie des Chaleurs, where a few years ago the cod fishery was carried on on a large scale along the coast, this industry had to be given up, the cod-fish having entirely disappeared.

Formerly, and I may even say lately, in the district of Gaspe, along the coast of Nova Scotia and New Brunswick, at no more than a mile from the shore, the fisherman could take every day a good quantity of fish; now the inshore fishing is not so remunerative, and fishermen have to go much farther out to sea to take the same quantity.

Then the expense of fitting out a boat was so small that eight shillings a quintal was considered a fair price for cod, but now this price is more than doubled.

No more than ten years ago the caplin was so abundant on our coasts that large quantities of it were used to manure the lands. Now our fishermen, through their own fishing, are obliged to go twenty-five, and sometimes forty miles to get enough of this fish to bait their lines.

Some one will perhaps say, your official reports show an increase, every year, in the number of fish caught. The reports are correct; but that does not necessarily prove an increase in the actual quantity of fish, for the number of vessels employed in our fisheries is also increasing every year. Let us also consider, that the men having to go twenty-five and thirty miles from the shore to fish, much more time is lost than when the fishing was pursued close to the coast. The fishermen cannot put out when there is a strong sea breeze. They are often kept on shore by storms which last for whole weeks. Sometimes they set out in fine weather, and no sooner have they reached the fishing grounds, than the wind rises and they are forced to return to land as quickly as possible ; and a season seldom passes, without our coasts being visited by squalls, so violent and so sudden, that the poor fishermen are obliged to scud home under bare poles and to remain in-doors for whole days at a time. Consequently, the time actually given to fishing is not so long.

In Norway and Sweden, if I am not mistaken, fishermen have also to go beyond the limit where the cod-fish was usually caught in great numbers ; and the statistics furnished by the inspectors of fisheries, show a large decrease in the number of cod-fishes caught in those countries during the last three years.

Is the failure of the Norwegian fishery due only to the severity of the weather, or similar temporary causes ? These are questions which I decline to answer, and that I leave to scientists and practical men to decide. Along the coast of Norway from Stavanger to Aalepind the herring resorts to spawn. Some years ago this important fishery was yielding as much as 800,000 barrels of fish, but since the year 1876, it has been gradually decreasing, and it hardly produces now 20,000, or 25,000 barrels annually.

Taking together the statistics of all the countries where the herring fishery is carried on, it may be said that, notwithstanding the immense quantities that have been, and are yet taken, the herring does not seem to diminish in number ; that it may present itself occasionally in smaller numbers at certain places, but that this is rather due to certain circumstances arising from the weather or the action of the wind.

This, in my opinion, is an erroneous calculation. The same quantity of fish may yet be taken ; but let us consider for one moment the improvements made in the fishing implements, and the increase in the number and size of fishing crafts. Boats employed in the herring fishery are now three and four times as large as those which were used twenty years ago, and instead of five or six nets, each boat has now forty or fifty nets of larger dimensions and better quality. Should not this fishery be more productive now than it was? If the herring were not decreasing in number, should not a fisherman, fishing with ten nets take more of them than when he was fishing only with three?

Great exertions are now being made by the several countries where fish culture has been introduced to apply this science towards the propagation of cod, herring, mackerel, and other sea fishes, and consequently protect sea fisheries.

May I ask what would be the use of endeavouring to increase, not only freshwater fishery, but sea fishes as well if the sea fisheries were inexhaustible?

The facts that I have just submitted for your consideration, and many others that could be mentioned, prove sufficiently the necessity of giving to the sea fisheries a fair protection.

Supposing even the truth of the theory that sea fisheries are inexhaustible, which theory I am not ready to admit, I think that in order to diminish for the fishermen the expenses of outfit, and the numerous dangers to which they are daily exposed, in order especially to procure to the poorer classes a cheap supply of fish, it would be advisable to take the means of submitting the sea fisheries to judicious regulations.

The legislators of Canada do not seem to believe that sea-fisheries are altogether inexhaustible, for in the laws that they have made to protect them, we read the following clauses:—

"No one shall use mackerel, herring, or caplin seine for taking cod-fish, and no cod-fish seine shall be of less size mesh than four inches in extension."

"No caplin seine will be used in herring fishing."

"With a view to protect the oyster beds in different parts of the bays and coasts of the Dominion, it shall not be lawful for any person to take oysters, or in any way to injure or disturb them, except during times and on terms permitted by special regulations, under a penalty of not more than one hundred dollars, and not less than forty dollars."

Strict regulations there are also, protecting the freshwater fishes.

In Ontario and Quebec, salmon cannot be taken with nets between the first day of August and the first day of May; between the fifteenth day of August and the first day of March in the provinces of New Brunswick and Nova Scotia; but fly-fishing is allowed in Quebec and Ontario between the first day of May and the first day of September, and in Nova Scotia and New Brunswick from the first day of March to the fifteenth of September.

The use of nets in the waters of the different provinces is regulated by law.

The meshes of salmon nets must be at least five inches in extension, the distance of nets from each other never less than 250 yards, and no salmon be taken within 200 yards of any spawning-ground. All salmon nets must be raised from Saturday evening until Monday morning of each week.

"It is not lawful to fish for or catch any white-fish, in any manner, between the nineteenth day of November and the first day of December, between the thirty-first day of May and the first day of August in the province of Ontario, or between the thirty-first day of July and the first day of December, in the province of Quebec."

"Gill-nets, for catching salmon-trout or white-fish shall have meshes of at least five inches extension."

Fishery officers and overseers are appointed by the Government to enforce these laws and many others which it would be too long to enumerate here.

Understanding the real value of our sea and freshwater-fisheries, their immense importance for the Dominion, our legislators have acted very wisely, I think, in subjecting them to strict regulations.

And in taking the means of economising and perpetuating such important sources of wealth, they are, in my humble opinion, working for the welfare, and in the true interests of our present and future fishing population.

DISCUSSION.

Mr. R. M. **WATSON** (Montreal), moved a vote of thanks to Mr. Joncas for his very able paper.

Mr. **JAMES** C. **PARKER** (London City Mission) seconded the motion. He said he had been visiting the poor of London for the last thirty years, and this question of fisheries was one of great practical importance to them. They were very fond of fish, and would be glad to have a supply at a low price. He used to think that he had done his duty to his mortal body if he had a fish dinner once a month, but since the opening of this Exhibition he had gone in for a fish dinner two or three times a week, and all his friends said he looked much stronger and better for it; and he must say that if he had not had those fish dinners he should not have had the courage to get up and attempt to make these few remarks. There were four millions of people in London, and what was to become of them, unless the supply of fish was increased, he did not know.

The resolution was put, and carried unanimously.

Mr. HERBERT HOUNSELL (Bridport), remarked that Mr. Joncas had mentioned Gibraltar as the southern limit for cod fisheries, but in so doing he must have forgotten the fishery at the Canary Islands. There was a large fishery going on there, conducted by a Spanish Company, where some 300 or 400 boats were employed, and the fish caught were dried on the coast of Morocco. That was certainly the most southern fishery of cod. He had been rather struck by the remark of Mr. Parker, as to the intellectual stimulus given him by a fish diet, and he believed medical men generally agreed with the opinion that there was a large amount of intellectual energy given by the phosphorous contained in fish food. As to the nutritive value of fish, it was a great pity that the inhabitants of London did not more thoroughly recognise its importance. He had been much struck in passing through the United States section, by a paper which was exhibited there, showing at a glance the comparative nutritive value of fish as compared with beef and other meats, and he thought probably it would astonish many persons present when he told them that dried cod was infinitely more nutritious per pound than the sirloin of beef. As to the rapid growth of Canadian fisheries, he might state that the town from which he came owed its main existence to fisheries. It was a thriving little town, and about 100 years ago the first shipment of fishing-nets and tackle was made from Bridport to the Canadian fisheries through a Jersey firm. This corroborated what had been said as to the antiquity of the Jersey fishery establishments on the coast of Labrador.

Professor BROWN GOODE was very pleased to express his great satisfaction with the paper just read, which seemed to him by far the most complete and satisfactory *résumé* of the fisheries of Canada he had ever heard, and contained many points of great interest. There were one or two things, however, concerning the Canadian fisheries which probably Mr. Joncas' modesty forbade him to refer to, but which he would like to mention. In the first place he would refer to the immense growth of the Canadian fisheries during the last ten years. In the course of his own studies he had occasion each year to peruse the Canadian Reports, and had been perfectly amazed at the rapidity with which this industry had developed. He also knew it to be a fact that the fishing vessels of Canada, and especially of the United States, had improved wonderfully in speed, size, and in general seaworthy qualities. He also wished to refer to the point which Mr. Joncas had not touched upon quite so much as he might have done, namely, the very efficient Government system of inspection which Canada had worked out. It seemed to him that the Canadian Department of Marine and Fisheries was one of the most valuable organizations in the world, and that their system of gathering statistics was one which other countries ought to study with a great deal of care. In the United States they had nothing of the kind. They had an inspection in 1880, but there was no permanent organization for gathering statistics. Another matter which he looked upon with admiration was the great progress Canada had made in fish culture during the last twenty years, and more especially under the direction of Mr. Wilmot, who was one of the pioneers of fish culture in

America. Another thing he ought to mention was the indebtedness of the United States to Canada, and especially to Nova Scotia, for the immense number of fishermen who came to the States every year. The Nova Scotia fishermen in the Port of Gloucester were numbered by thousands, where a large number of the finest vessels were manned and officered by them. Many of them came there and settled for life in Massachusetts, whilst others did so for a period of years, and returned home when they had achieved a competence. The fisheries of Canada and of the United States were so closely interwoven in all their interests that they really should be considered together, and compared very carefully with each other, and some calculations he had made convinced him that the annual production of the two countries amounted to more than all Europe, Great Britain excepted, namely, from 120 to 150 million dollars annually. It seemed to him that in Canada, as well as in the United States, the resources of the sea had hardly yet been appreciated. Here were millions of pounds of the most valuable food products annually wasted, and no doubt one of the results of this Exhibition would be that they would learn to make better use of them than they had hitherto done.

Dr. FRANCIS DAY said he had intended moving the vote of thanks for this interesting paper, but as that had already been done, he would only say a few words in continuation of the remarks which had been made. He quite agreed in what had been said, that these fisheries were still almost in their infancy, but still they found it necessary to protect them. In England they found in some places they did well by placing certain restrictions on the fisheries as carried on, especially in protecting the lobster fisheries.

Sir PHILIP CUNLIFFE OWEN said it was now his pleasing duty, as a member of the Executive, to propose a cordial vote of thanks to the Hon. Mr. McLelan, the Minister of Fisheries of the Dominion, and he thought the very fact of his taking the chair at the Conference, as a Minister of an important government, such as that of Canada, was a proof of the importance which that government attached to the protection and development of the fishing industries there. This gentleman, who had come over on the part of the Dominion Government, and had shed lustre on the Exhibition by his presence and active assistance, was, he believed, the only Minister of Fisheries throughout the civilized world. They had heard from Professor Brown Goode that there was none in America, and he knew that in Europe such a minister did not exist, and he wanted this fact to come home to them all. It was important that it should come home to all their foreign friends, and leave them to feel the great importance it was to the civilized world generally, to protect that which Providence had given them so bountifully. They knew very well that our teeming population in London depended a great deal on fish as food, and if they knew as much about it as one gentleman who had already spoken, and as Sir Henry Thompson, and many others including himself, did, they would know the benefit of not only one, two or even three fish dinners a week, but of fish and nothing but fish as food. They might smile at this, but he was convinced they would all feel healthier and better men and women if they were to live on fish. But there was another point which greatly affected the female portion of the population, and that was that they should know how to cook fish; unfortunately they did not know, and would not take the trouble to learn; but it was very important for the working-classes, and for them all, that their wives and housekeepers should know the variety of ways in which they could put before their hungry and tired husbands a good meal of fish. There was not a very large audience present; but that was because people knew that within a few days they would be able to read this very interesting and admirable paper of Mr. Joncas. He was much pleased as a member of the Executive to tender their thanks to him for his contribution, which no doubt would be studied in this country, and would be translated into every foreign tongue. The literature which was being prepared in connection with this Exhibition was, to his mind, with the little experience he had of exhibitions, the most important monument and record which had ever existed in any exhibition, because these were not dry blue-books of statistics, but interesting essays by practical men, who had come from all parts of the world to enlighten us in the knowledge for which they were distinguished; that knowledge would be spread over the length and breadth of the land, and he trusted very much that a system would be inaugurated during the coming winter whereby these essays might be read to large numbers of the fishing population, and he knew very well the interest with which they would be received, and the great benefit which might be expected to accrue. He could only assure Mr. McLelan that his presence was hailed with gratitude, and he was never tired of expressing to him and to the Dominion how glad they were to be able to receive him in the mother country, and how proud they were to have such intelligent and remarkable sons, showing the way to that which we had not yet learnt ourselves, and giving us lessons which we in this old country were willing to listen to, and he hoped to profit by.

Mr. WILMOT, in seconding the motion, said he felt sure the presence of the Minister of Marine and Fisheries had added much to the welfare of their great Exhibition, and when they learned that he was the only Minister of fisheries present, he thought that fact said a great deal for the country which sent him here. Had he been in Canada, he would have spoken more fluently than he could hope to do, because it was stated that in Canada about 100 lbs. of fish were eaten by each inhabitant annually, whereas here, they only ate 30 lbs.; he had certainly not eaten as much fish in this country as he did at home, and therefore the intelligence which was supposed to arise from the eating of fish would not be so manifest with him. This Exhibition was fraught with a good deal of good or harm. Good if they took hold of the sentiments put forward by Sir Philip Owen, but if of sentiments derogatory to fishing interests, which were put forward in what was to be considered one of the text-books of the world hereafter, then great injury would be the consequence. His friend and associate from Canada, Mr. Joncas, had read a most lucid and instructive paper; and, without desiring to eulogise it too much, he must say that if like views were in the inaugural address, it would have been fully better, and superior to those which were read, because there was a ring about this which meant protection to the fisheries of the world, whilst in that which was read, there was a prevailing sentiment that no protection was wanted, and he contended it was very injurious to put forward the idea that protection was not required. What did they find in this paper? That in Canada, a young country, fishermen found already that they had to go farther away to catch the fish. The fish came in near the shore to spawn, and went out into the deeper waters again to feed, and when an article of food like fish came to the shores of any country to reproduce they should be protected in that act, and not slaughtered as they invariably were. Was it not agreed that they should protect salmon when they came into the rivers to breed? Laws were passed, saying that men should not kill salmon for a certain period when on the spawning grounds, and did not tne same laws of nature hold good with regard to other fish? If any animal were destroyed in an advanced state of pregnancy, it was a mere matter of time to exterminate it, and if the herring or cod came from the deep waters to our shores to reproduce their species should it not be the duty of those who conducted the affairs of the country, to say that man should not destroy the pregnant creature, because by refraining from doing so a much larger quantity would be produced hereafter. What possible harm could there be to the fisherman to do this? it was doing him good; he would reap more fruit from it, and, not only he, but posterity after him. It was, therefore, in his opinion, the duty of Legislatures to pass some such measures as would prevent people continually killing these fish. There were twelve months in the year, and if during those twelve months there was one when the cod came to deposit their eggs and another one when mackerel came to spawn, why should not man be restricted during those particular months, and allowed to catch fish during the other eleven. Why should he fish 365 days in the year? It was found that the principal cod, herring, and mackerel fishing was within a certain distance of the shore, they were not caught so much in the greater depths of the ocean. Many people said the sea could not be exhausted, but that was a fallacy, because in every civilized country of the world they were using means to increase the number of fish, and it was evident that they found they were getting less and consequently were anxious that something should be done. Britain was one of the countries which did not pass laws for the protection of fish in the sea. All along the coast of Norway and Sweden fish were getting scarce, and within the three or four miles' limits where they used to catch cod, they were almost gone. They had to go farther and farther, showing clearly that they had destroyed them on the nearer limits. Professor Goode, in his lecture the other day, intimated that it was unnecessary to pass laws for the preservation of fish in the sea, but now he said that in Canada the progress was very satisfactory because it had judicious laws for the preservation of its fish. Within the last twenty-four hours he had received a letter from a very shrewd and clever fisherman of the Bay of Chaleur, in Canada, in which he said that (on account of the protection given and the immense number of young fry turned out into the rivers), on the 12th June, the day he wrote, they had caught more salmon than were caught last year altogether. He said—

"DEAR SIR,—I have been down here since the 1st, and am glad to say I have got more salmon already than the whole number we had last year, and every appearance of a very fine catch, and oh! such beauties, and even prettier fish than the old Restigouche salmon. So far they give an average of twenty-two pounds; of course markets are down, Montreal and New York glutted; we are now freezing the fish. My son wrote me from the Restigouche fishery on Saturday, telling me that he put 300 salmon in his freezer that day averaging 25½ pounds each, and says they are better than the 'big run' of 1879. Now, Mr. Wilmot, I am pleased at this, and I am sure you will be; but I confess it is nothing more than I anticipated, notwithstanding the jeers and scoffing of such poor narrow-minded wretches, who, carried away by spite, envy and malice, have done all they could to bring our efforts into public contempt; even parties from whom better would have been expected were almost convinced by these specious pleas, until the clear necessity and benefits of artificial breeding were shown as overcoming the natural losses of eggs and young fish from ice freshets, etc. • • •

"I hope your Exhibition is a success, as I know you will try to make it. If you can find time do drop me a line.
"Yours, etc.,
"JOHN MOWAT."

Some people said that the fisheries were inexhaustible, and if we could get practical knowledge that that was so, he would not object to it, but they had only theoretical knowledge of it. They were told the other day of a peculiar case which would prove that the sea was inexhaustible of fish, but if a theory were built on a theory there ought to be some practical basis to commence with. If it were theoretical from beginning to end it could be of no value. Having read the passage from the opening or inaugural address referring to the cod at the Islands of Lofoden, Mr. Wilmot said that was put forward to substantiate the theory that fish were so numerous that it was impossible to exhaust them, and, therefore, it was unnecessary to have judicious laws to protect them. He contended on the contrary that there was not a tittle of foundation to show, because codfish might be numerous there, that it was not necessary to protect them. There were 27,800,000 and odd square feet to the mile superficial measure. That would give 185,956,000 cod fish, supposing them to be in 60 layers 180 feet in depth. It was said they came in all along the coast continuously for two months, as the coast could not be less than 50 miles, that would give 9,000,000,000 of cod fish, and as they came in for two months or 60 days, multiplying that by 60 it would be 540,000,000,000 of cod fish within that area of 50 miles along the shore, and adding $\frac{1}{10}$ for herring space, the food of the codfish, it would cover 64,566 superficial miles of ocean. When theories were commenced in that way it appeared to him to amount to an absurdity. It was wrong to put forward such data to any intelligent community; it was unfair to the community and unfair towards those who had laboured for so many years to protect fish, and unfair to all who had stood on that platform, most of whom accorded with him in his views that fish should be protected. If documents of this kind went forth it would do a vast amount of harm, and he hoped the intelligence of that audience and Great Britain would go with those who were anxious to get laws passed to protect fish universally, not select one kind of fish because it was comparatively easy to protect them, but all fishes should be protected, because mankind needed them all. It had been a labour of love with him for many years to study the habits of fish, and he regretted that, with many persons at the present time, there was too much theory and too much science without practical knowledge at the bottom of it.

The motion was then put by Sir Philip Cunliffe-Owen, and carried unanimously.

The CHAIRMAN, in responding, said he felt quite overcome by the flattering terms in which the resolution had been proposed, and the enthusiastic way in which the work which he and his government were doing in Canada had been spoken of. It was true that the Government of Canada felt a deep interest in the preservation of fisheries, because they knew how important it was to her people that those fisheries should be used, and not abused. Their object had been that what some scientific gentlemen there called the balance of nature should be preserved, or that it should not be too much broken. The balance of nature had been running for centuries before the fishermen came in, and the proper proportions of fish were all preserved; the fishermen came in, and with their multiplied engines for destroying fish were likely to destroy the balance of nature, and so to destroy quantities of food fish, so important to the people of the Dominion and other countries, for they believed with proper care they should have large quantities for export. Sir Philip Owen said they should all live on fish, and certainly in going to the meat markets of England there was a great inducement for people to live on fish if they could. But if they would come over to Canada, and take a free farm—such as they were ready to give to millions of people—of 160 acres of as fertile land as ever rain or dew descended upon, they would have not only fish to live upon, but good beef, mutton, and poultry, and all else they desired to make a variety on their table. The Government of Canada not only passed laws, but believed it was necessary to provide shelter and protection on the more exposed portions of the sea coast to protect the lives of the fishermen. They had heard from time to time how dangerous was this occupation, and that it showed the largest percentage of loss of life of any occupation in which man engaged. In Canada they built harbours and breakwaters to which the fishermen in exposed places could resort in case of sudden storm, and young as they were, and poor as they had been, they had expended about six million dollars for that purpose. They had also been told that sometimes fishermen went out and toiled all day and night but caught nothing, but the Government had also endeavoured to provide against that by laying down telegraph cables along the coast to all the stations, so that when the fish struck on any particular point they could telegraph to all the fishermen who at once could come there and load their vessels. Professor Goode had referred to the fact that a great many Nova Scotians went to the famous fishing-port of Gloucester and manned their vessels, and that was no doubt the case; they found that in the summer their own fishermen were employed off the coast, but in the winter season they went to the United

States because they had a better class of fishing-vessels for winter service, and could go out to sea with more safety; they therefore encouraged the building of a better class of vessels in their own country, and for a number of years had devoted 150,000 dollars a year to this purpose, paying so much a ton for a better class of vessels, so that their own fishermen might be employed during the winter and not have to go to a foreign country. He had been referred to as a Canadian Minister to the mother country, and he must say it was a pleasure to him to be received in the kindly manner that he and his associates on the Executive Board had been received. He was proud of the phrase which he had used, coming to the "mother country." There was no name of which they were more proud in Canada than that they were sons of Great Britain; that they were connected with this great Empire, so glorious in her past, so great and mighty in her present, and which had before her such a grand and magnificent future. They were proud to be connected with Great Britain, but they were proud also that they were no weak helpless dependent members of the Empire; that they were no encumbering members, for they felt that they in Canada were bounding forward in prosperity; they were going forward with a great tide of healthful blood flowing in their veins and beating in their hearts, hearts strong for the present, and big with hope for the future, and hearts which he trusted would long be true and loyal like British hearts when waked by the strains of "God save the Queen."

THE
FISHERIES OF CHINA.

BY

J. DUNCAN CAMPBELL,

COMMISSIONER OF CHINESE IMPERIAL MARITIME CUSTOMS, AND
COMMISSIONER FOR CHINA TO THE INTERNATIONAL FISHERIES EXHIBITION.

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CONFERENCE ON WEDNESDAY, OCT. 24, 1883.

The Honourable SIR AMBROSE SHEA, K.C.M.G., Commissioner for Newfoundland, took the Chair.

FISHERIES OF CHINA.

AFTER the thousands of years that China has spent apart, the gulf of separation has now been fairly bridged over. Commercial treaties have opened the most important seaports and the interior under special regulations to foreigners, and the Chinese Government, while objecting "to have its hand forced," is watching and testing various foreign appliances, in order to judge how far they may, with advantage, be grafted on existing institutions. Thus, an Imperial College has been established at Peking for the study of Western languages and sciences; the coasts and the great river Yangtsze have been lighted with the most improved apparatus; steamers are taking the place of junks; mines are being worked by foreign machinery; and the telegraph now brings Peking within a few hours of London. The appointment of Chinese Ministers abroad, of distinguished officials like the Marquis Tsêng, and the co-operation of China in the international exhibitions of foreign countries are significant proofs of the importance that China attaches to the maintenance and extension of friendly relations and intercourse.

This is the sixth great International Exhibition in which China has taken an official part, viz., Vienna, 1873; Philadelphia, 1876; Paris, 1878; Berlin, 1880; Amsterdam, 1883; and London, 1883. On each of these occasions (excepting Amsterdam) the work has been entrusted by the Chinese Government to Sir Robert Hart, as the Inspector-General of Customs, and it has been executed under his directions by this important department of the Chinese Government, which employs about five hundred foreigners of various nationalities besides two thousand Chinese.

The Introductory Note to the Official Catalogue of the Chinese exhibits [China: Imperial Maritime Customs, Miscellaneous Series, No. 11] explains that the invitation to take part in the present Exhibition arrived too late for any extensive collection to be possible, but that steps were taken to procure specimens from Swatow, Ningpo, South Formosa, and Ichang, which is a river port in the centre of China and about one thousand miles from the mouth of the Yangtsze. The gentlemen in the Customs Service who assisted in the preparation of the collection were Mr. Neumann (German), who had the general management and brought the collection to London as Secretary to the Chinese Commission; Mr. Morgan (English), Acting Commissioner of Customs at Ichang; Mr. Drew (American), Statistical Secretary of the Inspectorate-General; and Mr. Novion (French), Commissioner of Customs at South Formosa—thus showing the international interest taken by the Chinese Customs Service in furthering the objects of the Exhibition.

The distance of China from the scene of exhibition, the shortness of notice received by China, and the difficulties of collection and transport must be taken into consideration in any comparison, if a comparison can be made, with countries accustomed to these competitions, possessing professional experts, public museums and private collections, and able, moreover, from proximity to London and facility of communication, to place their contributions *in sitû* at a very much less expenditure of time, money, and trouble than was incurred by China to do justice to the International Exhibition.

No doubt there is much superiority in scientific and practical interest, as distinguished from the element of popular attraction, in the contributions from the United Kingdom, the United States and Canada, and the Scandinavian and other countries, as compared with China; but the chief points of interest and instruction in the Chinese contribution consist in the types and models, the nets and other implements of distant antiquity, preserved and used to the present day, and shown to be adaptable with the latest resources and developments of science and practical sagacity in relation to the subject matters of the Exhibition.

The following is a short summary of some of the principal points or features in the Chinese exhibits, taking them in order of their classification in the Official Catalogue.

1st. *The Bamboo.*—Of all the materials used by the fisherman, the bamboo is the one that deserves the first notice. Its cheapness and durability, as well as the variety of purposes for which it is used, entitle it to the highest rank in domestic economy. The use of the bamboo is largely illustrated in the Chinese Collection. There are the catamarans or surf-boats of South Formosa, fishing-rods, supports for nets, crab and prawn pots, fish baskets,

&c., &c. Williams, in his 'Middle Kingdom,' designates the bamboo as the national plant of China, and says:—"It furnishes the bed for sleeping and the couch for reclining, the chopsticks for eating, the pipe for smoking, and the flute for entertaining; the chair to sit upon, the table to dine from, food to eat and fuel to cook it with, are alike derived from it; 'the ferule to govern the scholar and the book from which he studies,' the warrant to arrest the criminal, and the rod to punish him, all 'originate here' —from this magnificent plant, whose graceful beauty when growing is comparable to its varied usefulness when cut down."

2nd. *Nets.*—The Chinese nets are all hand-made from hemp, cotton, or silk; and, after being boiled in a decoction of mangrove bark, are steeped in pig's blood or wood oil to strengthen and preserve them. Silk nets, which fo centuries have been used in China, are now being employed in European countries, but for cheapness they cannot compare with the Chinese models. There is an immense variety of nets in use by the Chinese fishermen, and amongst the specimens in the Chinese Collection are several deserving notice, some of them being similar to those used in western countries, such as the dip-net, casting-net, trawl-net, etc.

3rd. *Fishing-boats.*—If China contains as many millions of people as there are days in the year, and if at least one-tenth of the population derive their food from the water, *necessity* will have caused them to invent many ingenious ways for securing the finny tribes (Williams' 'Middle Kingdom.') Among such devices the "Cormorant" boat (p. 46 of Catalogue) deserves mention as exhibiting in a remarkable degree the shrewdness, skill, and patience of the Chinese fishermen. The "Moonlight"

Fishing-boat (pp. 20 and 45 of Catalogue) is another device, which is found also in India and Siberia. There are models, in the Chinese collection, of the fishing-boats of Swatow, Ningpo, South Formosa, and Ichang. In spite of their apparent clumsiness they turn as on a pivot and promptly answer the helm. They are good sea boats, and are built in watertight compartments, or rather in compartments *intended* to be watertight. The wonder is that, in the ages of the "Ark" and the "Argo," the Chinese should have possessed such practical and efficient vessels; for it is evident, from old books and drawings, that this was the type of boat then in use.

4th. *Harbours, etc.*—All along the coasts and the great river Yangtsze, the fishermen have seen the gradual yet rapid extension of the Lights that have been erected by the Customs department of the Chinese Government during the last twenty years; and they cannot but appreciate the benefits that the Lights have conferred in aid of their industry and in the protection of their property. Quoting from the *Times* of 15th May last:—

> "Conspicuous at the end of the Court are two large maps of the Celestial Empire, one showing its physical configuration and the other its provinces and towns, &c. The activity shown by the important Chinese department of State over which Sir Robert Hart presides, is exemplified by the many red discs on the China coast which indicate the lighthouses and lightships erected since he became Inspector-General of Customs at Peking in 1863. At that time there were but two small lights in the Canton district and a lightship at Shanghai. Now there are 73 lights, 4 lightships, 54 buoys, and 50 beacons, and it is the ambition of the head of this department to see the dangerous coasts of China at least as well lighted as the shores of the British Channel. Of one of the most important lighthouses—that on Breaker Point in the Swatow district—a model is exhibited. It is an iron tower

120 feet in height, which was constructed on a new plan by Sir W. G. Armstrong and Co., and so strongly braced and supported by exterior iron rods that it has withstood the shaking of two earthquakes and the force of several typhoons."

Such progress in the lighting of the coasts of China is perhaps without a parallel in the history of the cares and precautions that a Government can take for the protection and advantage of its fisheries and fishermen as well as the maritime commerce of the world. The work itself will be a lasting record of Sir Robert Hart's administration :

> "Famam extendere factis,
> Hoc virtutis opus."

5th. *Boats in general.*—"The original model of the junk" (according to Williams) "is said to be a huge sea monster ; the teeth at the cutwater define its mouth, while the long boards on each side of the bow form the armature of the head, the eyes being painted on them ; the masts and sails are the fins, and the high stern is the tail frisking aloft." As regards the eyes, which are so conspicuous on all Chinese junks, most of the foreign steamers trading on the coast have them painted on their bows or paddle-boxes, as a concession to Chinese ideas ; their use being defended in the picturesque dialect known as "Pidgin English" by the remark—

"Spose no got eye, how fashion can walkee !"

The large trading junks, of which there are some fine models in the Chinese Collection, are finding important rivals in the steamers of the China Merchants' Steam Navigation Company, which, commencing in 1872 with two vessels of 1,168 tons, had in 1880 a fleet of twenty-nine vessels of 20,747 tons ; and considerable additions have since been made.

6th. *Economic Condition of Fishermen.*—The Chinese fishermen are very frugal. In the Chinese Catalogue (pp. 4 & 5) are given some interesting particulars relating to their condition, earnings, guilds, etc. Without any knowledge of political economy or the laws of capital and labour, they have solved the question of distribution of profits in a practical manner and to the satisfaction of all. They are very charitable and help each other in times of distress, there being no benefit or insurance societies. In the Chinese Collection there are specimens of the garments worn by successive generations of Chinese fishermen, and proved by long experience to be the best adapted to the conditions of their work. There are also models of their huts, and of their Guildhalls and temples, showing not only the domestic economy but also the civil and religious organisation of the craft, and illustrating in a striking manner one curious line of connection between East and West—from the Guildhall of the fishermen at Haimên to the Fishmongers' Hall in London—from the fishermen's temples with their annual festivals on which large sums are expended, to the religious processions and services on the western shores of France.

7th. *Corals, etc.*—Shells of all descriptions are plentiful in China, and are used in various ways :—for windows, fog-horns, ash-cellars, necklaces, scoops, flower vases, etc., of which there are several specimens in the Chinese Collection. The unique Buddha shells (p. 49 of Catalogue), which have attracted the observation of visitors, constitute a very important and successful industry at Hangchow.

The cultivation of oysters is on a very large scale, and dates from a remote age. A model of an oyster bed is shown in the Chinese Collection, and a description of the oyster fishery is given at pp. 13 and 59 of the Catalogue.

Notwithstanding the enormous consumption of oysters from time immemorial in China, there appears to be no diminution of the supply. In the north on the shores of the Shantung promontory, at the mouths of the Yangtsze and Ningpo rivers, all along the coasts of the Fohkien and Kwantung provinces, and on the seaboard of Formosa, the cultivation of oysters is carried on with much skill and success. Considering their dearness and scarcity in Europe, a thoroughly scientific inquiry as to the methods pursued by the Chinese would undoubtedly yield important results.

8th. *Fish-markets.—Appliances for Transport of Fish, etc.* —A model is shown of a Ningpo ice-house (p. 48 of Catalogue), which is used not for purposes of refrigeration, but for storing ice during hot weather. The ice is principally used for the preservation and transport of fish, and is supplied to the fishing grounds by ice-boats specially constructed. These ice-houses are of very primitive construction but are most effective, and are capable of preserving ice for a period of three years. There are also some interesting models of saltpans, and the manner of their use is described at page 11 of the Catalogue.

9th. *Fish Breeding.*—In the district of Swatow there is no regular system of pisciculture, and the only approach to it consists in fish-ponds that are described at page 11 of the Catalogue; but Monsieur Dabry de Thiersant in his important work, 'La Pisciculture et la Pêche en Chine,' enters very fully into the matter, and gives China the credit of having been the first to practise this art at a very remote age. In *Land and Water* there is also a very interesting Paper, written by Mr. Kopsch, Commissioner of Chinese Customs, on Pisciculture in Kiangsi.

10th. *Fish—Natural History.*—There is a valuable article on the ichthyology of China, by Sir John Richardson, in the

Report of the British Association for 1845, but there is no foreign work on the fishes of China like Dr. Day's exhaustive treatise on the fishes of India.

The collection of fish from Swatow, consisting of about 170 different specimens, were wrapped up in linen and packed in cotton saturated with spirits of wine, and arrived in perfect condition. Coloured drawings of the specimens were made by Chinese artists, immediately upon the fish being taken from the water, and these specimens form a kind of picture gallery in the Chinese Court. Similar drawings on a smaller scale were taken of the fish of South Formosa, of which there are ninety specimens exhibited. Nearly all the fish enumerated in the Catalogue (pp. 32 to 40) are fit for food, and amongst them are soles, eels, mullets, perch, and many other kinds that are familiar to us here. The salmon and trout are missing, but Mr. Wilmot, the Canadian Commissioner, is confident that they can be successfully introduced and reared in Chinese waters. There is also exhibited a variety of crabs, nearly all of which are used for food, whilst the shells are turned into scoops or other useful domestic articles.

11th. *History and Literature of Fishing.*—The Chinese possess very old works relating to fish and fisheries, as well as scrolls, mottoes, tablets, &c. Some of these are displayed on the sides of the Chinese Court. They carry the literature backwards into remote antiquity—to centuries before the dawn of Western literature on the subject. The Chinese Commission for the Fisheries Exhibition had, moreover, the advantage of securing the personal co-operation of the Chinese Minister in England, the Marquis Tsêng, and His Excellency himself contributed two large scrolls and various characters, written by himself, containing historical and poetical allusions to fishing, which are described in the supplement to the Catalogue.

It may here be stated that the Catalogue of Exhibits and the List of lights on the Chinese Coast, are specimens of Chinese Customs' publications, printed at the Customs' Press, Shanghai, by Chinese compositors under a foreign superintendent.

12th. *Fine Arts.*—Reference has already been made to the drawings of fish painted by Chinese artists, and there are other pictures, in the shape of scrolls, showing the various modes of fishing. Such pictures are very common in Chinese dwellings. But the chief decorations of the Chinese Court consist in the allegorical productions of the Chinese artist, Têh-Ah-Kew, whose freehand drawing and brilliant colouring give point to the motto, "*Ex Oriente lux.*"

13th. *Fishes of Commercial Value.*—No country shows the commercial value of fish in a stronger light than China. As an almost universal, or at any rate as a widely distributed article of food, fish is a more important staple in China than in any other country, and her exhibits may be considered as indicative rather than exhaustive evidences in this connection. The whole country displays an extraordinary development of industry and commerce in marine and fresh-water fish. The latter is cultivated in rivers, lakes, and ponds, and made use of as a common article of food throughout the empire. Fishes of a kind which in Europe are scarcely deemed worthy to be caught, and then for sport rather than food, are in China utilised and form the subject of an extensive commerce as the staple food of a large section of the inhabitants. Even the re-
sive and hostile shark of the Western Nations becomes

an article of commercial value in China, and is habitually treated as an article of food for the million without dismay by the ancient Oriental wisdom.

In conclusion, attention may again be drawn to the peculiar nature of the Chinese Exhibit. Of necessity hastily gathered together from remote quarters, with no aid from public museums or private collections, the Chinese Exhibit does not compete with those of other nations. The Chinese fisheries, as now carried on, date from and have a succession of thousands of years, and the Exhibit ought therefore to be judged by way of contrast rather than comparison. It is by reason of this very difference from the general routine of the exhibits from other countries—introducing, as it does, some new and picturesque features characteristic of the nation—that the Chinese Exhibit has been so attractive to the public. But it is hoped that, beyond its popular attractions, it has also been a source of interest and instruction to the practical minds of those most conversant with the varying systems of fisheries throughout the world.

DISCUSSION.

Mr. WILMOT said that as his name had been mentioned in the Paper he might say briefly he had no doubt the salmon could be introduced to any part of the world where the water was of such temperature and clearness as to suit their habits of life. When they found that through the operation of pisciculture salmon had been introduced from Great Britain to waters below the Equator, where they were not indigenous, he saw no reason why it should not be equally possible to introduce them elsewhere, particularly in a country like China, some of the rivers of which he was strongly inclined to believe were frequented by salmon, but even if that were not the case he was quite sure that many of her more northerly rivers were adapted to this fish. It was a mere question of temperature and limpidity. The Sacramento river in California, where the atmosphere sometimes rose to 120° in the summer, was at one time overflowing with salmon, though it had been to some extent reduced by over-fishing now.

Mr. **CHARLES FRYER** (Home Office) proposed a vote of thanks to Mr. Campbell. He thought it was a very good omen that they had just had a Paper read on the fisheries of Newfoundland, with the Secretary of the Chinese Legation in the chair, whilst now they had had a Paper on the fisheries of China with the representative of Newfoundland in the chair. Sir Ambrose Shea had taken occasion to illustrate the proverb that blood was thicker than water, by referring to the undoubted loyalty of the colonists, but he might remark that water had something to do besides separating nations; they so far united them that all nations were agreed in recognising the importance of the fisheries: the concluding words of this Paper fully exemplified this point, and showed the lesson which might be learnt from the exhibits furnished by different countries. With regard to the fisheries of China, and to the enormous capture of fish there, he should like to ask whether he was right in thinking that the Chinese captured not only mature but immature fish at all times and in every possible manner. He understood that the Chinese in California surprised the Americans by the wonderfully small fish which they caught and ate, and if the same habit prevailed with the three hundred millions of Chinese in their own country, and they were continually catching these small fish in season and out of season, it afforded a strong argument against the possibility of depleting the waters. With regard to fresh-water fish, China was far ahead of any other country in fish culture, and made up for the great drain on the resources of the rivers in this way, but so far as the sea was concerned he was not aware that fish culture was carried out. If the small fish were continually destroyed it was a strong argument against any interference, unless absolute necessity for it were proved, with modes of fishing that might unfortunately destroy small fish, if, as seemed often to be the case, this was unavoidable in catching the large ones.

Mr. SAYER, in seconding the vote of thanks, said that Englishmen ought to be very thankful for the knowledge which was now brought to them by gentlemen who contributed these Papers as to the fishing industries of other countries.

Mr. WILMOT said he could not allow Mr. Fryer's remarks to pass without a word or two. Being a strong advocate of the artificial propagation of fish, and of their protection generally, he felt bound to point out that the temperature and climate of China was very warm, and consequently the fish there produced their young in very warm water. They knew that under such circumstances fish were hatched in as many days as it took months in colder climates, and thus the propagation and natural increase of fish there would be a thousandfold greater than in England or in Canada. The salmon family took from three to six months for the eggs to incubate, whilst some other descriptions that laid their ova in the hot weather would hatch out in from sixty hours to six days. There was therefore no foundation for the idea put forth by Mr. Fryer that because protective laws might not be in operation in China they were equally unnecessary elsewhere.

Captain CURTIS, R.N., said the Yellow Book stated that the Chinese caught small fish, with fine nets made of silk; those with which they caught them were to be seen in the Exhibition; but he understood that they were then transferred to ponds, and also, that when the water was cold they lit hanging fires to warm it, so that the young fish were taken care of—not destroyed or eaten when small; in fact they catch the fry in shallow waters, and transfer them to ponds and lakes; they are then sold alive.

Mr. FRYER said the fact that young fish were preserved and reared did not prove that small fish were not also very often eaten; but the fact of fresh-water fish-culture did not touch the question of the sea fisheries to which he particularly referred.

Captain CURTIS added that the Chinese were to be congratulated on using luminous paint, which was not much employed in this country at present. As a seaman, he must bear testimony to the excellent qualities of the Chinese junks and their fishing-boats; in fact, he thought naval architecture had not much improved the sea-going qualities of ships in this country; he would sooner be in a Chinese junk than in an ironclad, as the junk would ride over the sea in a gale, whereas the sea would wash over the ironclad.

Mr. HERBERT E. HOUNSELL thought the remarks of Mr. Fryer ought not to go forth uncontradicted unless they were more fully substantiated. The idea he had thrown out that the Chinese caught small fish all the year round and ate them, had not yet met with any support.

It was a mistake to suppose that there were no kinds of fish which could be destroyed by over-fishing, which some people might fancy to be Mr. Fryer's opinion, though he did not believe such was meant by his remarks; they had only to bear in mind the great decrease of soles within an area of three or four miles from the coast. To corroborate this opinion, he could speak of their almost total disappearance from the West Bay, and also the disappearance of shoals of mackerel off Folkestone, and Kingsdown, near Deal; the population used to live on catching mackerel during the summer months, but within twenty years the constant increase of mackerel boats had broken up the shoals, and, although they were not destroyed, they were so much lessened that it no longer paid to catch the fish. He could also quote an instance of a trout-stream which was depopulated by over-fishing, and the Angling Society were compelled to forbid any fishing for three years. It was a matter of common sense that if too large a proportion were caught, although the powers of reproduction might be enormous, still there must be a fatal result. He hoped that at the close of the Exhibition the scientific men connected with it would still prosecute further inquiries into the habits of fish, in order to determine how far regulations were required for their protection.

Mr. **Fryer** said he certainly did not intend to express the opinion that it was impossible to destroy all fisheries. On the contrary, he had shown over and over again, that it was possible for certain inland and other fisheries to be exhausted. What he wished to state was, that before any hasty steps were taken to prevent the capture of fish, they should be quite certain that those steps were necessary; and it seemed to him that the case of China afforded an instance which should make them pause before any hasty steps towards legislation were taken.

Mr. **Neumann** said it was satisfactory that the Paper which had just been read should have called forth such a lively discussion. The question raised by Mr. Fryer was one which had sprung up at all the conferences that had been held; and, before the advocates of complete freedom of fisheries or those in favour of protection, or rather the interference of Government, could avail themselves of any data furnished by China it would be necessary for scientific men to make a thorough inquiry into the state of Chinese fisheries.

Surgeon-General GORDON, C.B., said it might be *à propos* to the question under discussion to state that a few years ago, when travelling through Burmah, he found that the natives carefully protected the young fry of fish, using such implements as enabled the smaller fish to escape; and he was informed that there was a law absolutely prohibiting the capture of fish under a certain size.

The vote of thanks having been passed unanimously,

Mr. CAMPBELL, in replying, explained that the Paper he had read was not so much on the Fisheries of China as on the Exhibits from China to the Fisheries Exhibition; and one object of the Paper was to state a few facts that were not generally known, but which, when known, might add to the interest of the Chinese Court and Collection.

Mr. FUNG YIH, Secretary to the Chinese Legation, proposed a vote of thanks to the Chairman. With regard to the bamboo which had been referred to in the Paper, it might be interesting for them to know that it had recently become a source of industry in England, one of the daily papers being made of it at, he understood, a reduction in cost of two-thirds. The motion was seconded by Mr. Hounsell and carried unanimously.

A SKETCH

OF THE

FISHERIES OF JAPAN.

BY

NARINORI OKOSHI,
MEMBER OF THE JAPANESE CONSULATE IN LONDON.

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CONFERENCE ON TUESDAY, OCTOBER 23, 1883.

Mr. SONODA KOKICHI (Consul for Japan) in the Chair.

THE CHAIRMAN, said it gives me much pleasure to introduce to you Mr. Okoshi, our lecturer, on this occasion. Before he proceeds to read his Paper, you will, perhaps allow me to make a few remarks. It was my intention to lay before you an official Paper in connection with the fishing industries of Japan. But I regret that, owing to the absence of any statistical information from my government on the subject, I have not been able to do so. My friend Mr. Okoshi, however, kindly undertook the task of preparing a Paper which he will have the honour to read to you presently. But I must mention that, being left without such desirable information as I have stated, he has met with no small amount of difficulties. He has had to gather information from various semi-official sources, while he is not professionally connected with fishing industries. If you observe, therefore, any shortcomings in his treatment of the present subject, I desire you to attribute them to the circumstances under which he has had to labour. If you find, on the other hand, anything interesting or valuable in his Paper, it would be a source of great satisfaction to him as well as to myself.

THE FISHERIES OF JAPAN.

INTRODUCTION.

It would be perhaps too audacious on my part to attempt to speak on this subject, which I have never made the particular object of my study, and with which I have never been connected, especially before such a select audience as this, and after many interesting Papers have been read by eminent specialists at this Conference. But at the same time, it would be a matter of great regret to lose this opportunity kindly afforded me, without showing you what deep interest Japan takes in this question, and what extensive fisheries she possesses. I am sorry to say, however, that for want of deeper knowledge, and of the materials which I could not obtain in London, I am not enabled to give you ample information upon Japanese fisheries, which embrace such a large field of investigation and require a great deal of experience. No doubt many things will be left to be desired, this I hope you will excuse. I shall try, nevertheless, to give you a general idea of our fisheries.

The geographical situation of Japan with respect to the continent of Asia is very similar to that of Great Britain to Europe. Our Empire consists of the mainland, Kiushiu, Shikoku, its northern provinces of Hokkaïdo or Yeso, the Kurile Islands, Okinawa, better known as Loo-choo, and the Bonnin archipelago in the south; it embraces an almost tropical zone of 24 degrees of latitude, and a glacial zone of 51 degrees. This peculiar situation of our country affords us most extensive fishing-grounds, and its variety of climate produces in the Japanese sea almost every sort of fish imaginable; while in the interior, which is traversed by many rivers and brooks, and interspersed with lakes, fresh-water fish is also abundantly found. Either on account of our geographical position, or from some other cause, the chief food of our people has been, and is still, fish, which in Japan is eaten as meat is in this country. Although the use of flesh-food was introduced by foreign intercourse, yet it has not, and I think will not, take entirely the place of fish; far from such being the case, only the better class of people can afford to live on meat. Hence it appears to me that there is a great difference in this respect between the people of Japan and those of this country; the difference is, that in Japan even the poorer class of people can live on fish, while fish is chiefly a luxury for the better class of the English community. Therefore it is needless to say that Japan takes a great interest in this question of fisheries, though it is a matter of regret that our section in the Exhibition is not so largely and well represented as might be desired.

I.—SEA-PRODUCE.

Our fishing-ground is estimated to contain over seven millions of cho, *i.e.* about eighteen millions of acres: compared to the cultivated land of about eleven millions of acres there is a difference of about seven millions of acres in favour of the sea; supposing one acre of land produces one ton of corn, a fishing-ground of the same extent should produce seventeen times as much, if it be properly worked. If such be really the case, Japan should produce tens of millions of tons of fish. Indeed, our fishing-ground not only produces fish, properly so-called, crustaceans and molluscs, but it also abounds in salt, also several kinds of sea-weeds, which are largely taken by our fishermen and consumed most extensively in Japan. According to the returns from the Imperial Statistical Bureau for 1879, the quantity of our sea-products was as follows:

Salt fish	13,297,054	Kin.*
Dried fish	4,713,868	„
Salted Sardines	31,752,119	„
Total	49,763,041	„

Hence it must be about fifty millions of pounds' weight. Salt was produced in that year to the amount of 4,848,199 koku,† being about twenty-seven million bushels.

The above statistics are exclusive of the products of Yeso and the Loo-choo Islands. The following table shows the quantity of sea-products of Yeso for the year 1878:

Salmon	69,149	Koku	Each containing 6,000 fish	=	41,489,400 fish.
Masu (Spring Salmon)	12,471	„	12,000 „	=	14,965,200 „
Cod fish	11,296	„	6,000 „	=	6,810,600 „
Herrings	515,481	„			
Sardines	180,171	„			63,265,200 „
Sea-weeds	60,615	„			
Bêche de mer	12,293	„			
Total	861,476	„			

While I was writing this Paper, a most interesting statement, showing the statistics of our sea-produce by diagrams and map, was received by the Japanese Consulate from our Department of Commerce and Agriculture.

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* One kin is equal to English lb. 1.32377.

† One koku is equal to about 5 bushels and half.

From this document, which has been specially prepared for the National Fisheries Exhibition held in Tokio this year, it appears that Japan and Yeso, excluding other dependencies, produced in 1881 :

Salt	910,331,833 Kin.
Dried fish	4,550,422 „
Salt fish	80,561,944 „
Dried Sardines . . .	194,657,489 „
„ Sea-ear . . .	976,684 „
„ Shrimps . . .	3,373,999 „
Cuttle-fish	2,458,586 „
Bêche de mer . . .	522,066 „
Colle Végétale . . .	1,699,058 „

Exclusive of salt and sea-weed, the total quantity amounts in round numbers to two hundred and eighty seven millions. It must be borne in mind that in this enormous amount of sea-produce, fish which is consumed fresh, and also fresh-water fish, are not included. As to the latter kind of fish, as well as those used for manure, their quantity must be enormous, considering fish is more eaten when fresh than in any other state. It seems difficult everywhere to obtain accurate statistics of fish consumed fresh ; and there appears no return for it in Japan. If it could be ascertained, we should find that the quantity of fish we consume yearly is something fabulous. Take, for the sake of argument, the town of Tokio, containing about one million of souls, what will be the daily consumption of fish ? Supposing, for instance, that one-half of its inhabitants being too poor to buy fish (although this might not be the case), lives on rice and vegetables only, and the other half lives upon fish and rice ; supposing, again, each consumes half a pound of fresh fish every day, the daily consumption of fish in Tokio alone would be 25,000 lbs. We may infer from this what an enormous quantity of fish is supplied by the Japanese seas and rivers in a year to feed thirty-six millions of people. The total value of our sea-products is estimated at about thirty millions of yen.

At first sight this vastness of our fish-products seems too astounding, and it might be doubted whether the above statement might not be an imaginary conclusion; but when we find what is the real fishing power of Japan, this doubt will vanish away at once.

II.—FISHING POWER.

We find in the official return[*] that the number of our fishermen (I presume that those who are employed in fishing, not being *bonâ fide* fishermen, also women and boys are included therein) is stated to be 1,530,795; fishing boats, 187,220; nets, 436,999. These 1,530,795 fishermen are distributed among 341,470 families, about five people on an average forming one family.

The number of British fishermen is estimated to be—

England . . .	42,000
Scotland . . .	48,000
Ireland	24,000
Total . .	114,000

and the tonnage of fish caught in British water at 550,000, each fisherman catching about five tons of fish every year. Now, supposing one third of 1,500,000 be *bonâ fide* fishermen, and each catches the same amount of fish as a British fisherman, they would catch 2,500,000 tons. I am sorry I am not enabled to state the economical condition of fishermen and the capital employed for fisheries in general, nor could

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[*] This statement, extracted from official returns, is found in the Keizaïzäshi (Japanese 'Economist') of June 9th, 1883.

I state the tonnage of the 187,220 fishing boats, without misleading the reader by rough calculation. However, the majority of those boats are Japanese junks, strongly built and not of very large dimensions, carrying from 5 to 12 persons; but some must be sailing boats of European build. This enormous amount of fish, shell-fish and sea-weeds captured by an army of fishermen, is for the most part consumed at home, but some is exported abroad.

III.—JAPANESE FOREIGN TRADE IN SEA-PRODUCE.

Our sea-products occupy one of the most important classes of our exports, and there is a prospect of great increase. The following figures show a remarkable development of this branch of industry.

EXTRACT FROM OUR IMPERIAL CUSTOMS RETURN.

Dried fish, sea-weeds, shells and fish oil, 14 different articles in all, exported to foreign countries.

Quantities.	Declared Values.
1871.—19,547,000 Cty.	1,133,000 Yen.
1876.—28,668,000 „	1,626,000 „
Increase, 9,121,000 Cty.	Increase, 493,000 Yen.
1881.—40,007,000 Cty.	2,415,000 „
Increase, 11,339,000 Cty.	Increase, 789,000 Yen.

It must be remarked that from 1871 to 1875, during 5 years, our exports in sea-products have increased about 46 per cent.; and from 1876 to 1881 during 5 years, 39 per cent in quantity; and from 1871 to 1881, during 10 years, they have more than doubled, both in quantity and value.

EXPORT OF SEA-PRODUCTS TO FOREIGN COUNTRIES FOR THE YEAR 1880.

To	Cuttlefish.	Sea-weed.	Dried Sea-Ear.	Colle Végétale.	Bêche de Mer.	Shells of Sea-Ear.	Other Articles.	Total.
	Yen.	Yen.	Yen.	Yen.	Yen.	Yen.	Yen.	Yen.
China	647,761	696,735	261,799	286,838	234,015	5,608	207,423	2,340,179
England	..	..	..	2,575	..	99,464	3,238	105,277
France	..	..	..	910	.	2,525	5,760	9,195
America U.S. . . .	621	6	957	578	..	6,723	1·669	10,554
India	5	..	3	856	..	..	..	864
Russia	..	1	..	..	..	..	749	750
Germany	..	..	..	..	..	..	12	12
Denmark	..	..	..	..	..	..	15	15
Australia	..	..	..	..	..	..	120	120
Holland	..	..	..	..	..	..	10	10
Italy	..	..	..	..	..	500	730	1,230
West Indies	..	..	..	..	..	..	33	33
Other Countries . . .	..	..	..	..	..	..	19,958	19,964
Total . .	648,387	696,748	262,759	291,757	234,015	114,820	239,717	2,488,203

It will be seen from the above table that we exported to the value of 2,488,203 yen, and from this amount 2,349,199 yen were to meet the demand of China alone.

The following table shows our imports of sea-products from other countries for the same year :

	Tortoise Shells.	Corals.	Other Articles.	Total.
	Yen.	Yen.	Yen.	Yen.
China	6,479	626	35,805	44,910
England	6,855	..	5,863	12,718
France	412	..	1,318	1,730
America, U.S.	157	..	853	1,010
India	75,050	100	12,664	87,814
Russia	..	..	2,410	2,410
Germany	875	..	1,613	2,488
Australia	243	..	..	243
Holland	1,299	..	..	1,299
Italy	..	124,797	124	124,921
West Indies	30,480	..	600	31,080
Other Countries	13	..	3,695	3,708
Total	122,564	126,822	64,945	314,331

It must be pointed out that we require very little importation of foreign sea-products. From the above table it will be seen that tortoise-shell and coral form the largest amount of the imports, and naturally enough the former is largely imported from India, and the latter from Italy. These two articles are used in Japan chiefly for ladies' hair ornaments.

Let us see what was the state of our exports to China alone, in the following six principal sea-products for the last three years.

1880.	Quantity. Cty.	Value. Yen.
Dried Sea-ear	1,069,667	261,799
Dried Cuttle-fish	3,913,788	647,761
Bêche de mer	518,474	234,015
Colle Végétale	1,341,823	286,838
Sea-weeds	23,375,871	577,427
Do. cut	3,170,024	119,307
Total	33,388,857	2,127,147
1881.		
Dried Sea-ear	850,370	212,050
Do. Cuttle-fish	2,750,644	476,565
Bêche de mer	577,889	285,839
Colle Végétale	1,293,900	330,335
Sea-weeds	27,637,094	681,323
Do. cut	4,212,021	158,499
Total	37,422,018	2,344,611
1882.		
Dried Sea-ear	1,064,109	283,385
Do. Cuttle-fish	3,724,488	645,227
Bêche de mer	661,849	271,648
Colle Végétale	758,936	206,616
Sea-weeds	22,831,872	408,279
Do. cut	4,059,545	121,837
Total	32,100,799	1,936,992

IV.—FISH AND SHELL-FISH OF DIFFERENT KINDS FROM THOSE USUALLY EATEN IN ENGLAND.

Differences of the Japanese seas, and also differences of climate, may produce fish and shell-fish which are not seen in the English market, but which are consumed in Japan. Some perhaps may be caught in British seas, but are not used for eating purposes, as the taste and customs of the people are different. Again, the fish most *recherché* in Japan is not so in this country. The most common and largely consumed fish, called Maguro or tunny-fish, varying in size from 3 feet to 7 or 8 feet in length, is not seen in this country. Whether the British sea does not produce it or it is not caught by fishermen, I do not know, but this fish is largely caught and consumed in my country. Although, I think, Octopus, Cuttle-fish, Sea-ears, and Bêche-de-mer may be found in British waters, they are not eaten in this country.

On the contrary, eating Cuttle-fish may be looked upon with horror by the people of London, while in Japan they are readily eaten. This point has been referred to by Mr. Henry Lee in his most elaborate paper entitled 'Sea Monsters Unmasked,' with illustrations of a Japanese fishmonger's shop, where a large cuttle-fish hangs down, with its feet touching the ground; in every Japanese fish shop indeed, this ugly looking animal is exhibited, his head hanging on a hook. Its size varies according to its species and locality, but a very large one is never eaten; it is generally eaten when from one foot to three feet in length in its normal state, that is to say, when it is uncooked, because once boiled, it shrinks to half its length, and gets stouter and its skin becomes of a dark-red colour. Cuttle-fish is eaten fresh, dried, or salted, but is generally consumed fresh. Again, sea-ear and bêche de mer are largely consumed fresh, but a great amount of them is dried and used for exportation to China, and the shells of sea-ear are now exported to Europe for the manufacture of buttons and other purposes. There are many varieties of shell-fish, families of molluscs, including oysters, lobsters, crabs, &c., which are eaten.

Among sea fish, the most esteemed in Japan are sea-breams (*Chrysophyrys major*), turbot and sole, and the family of tunny-fish called Katsuo, but smaller in size, varying from one to four feet in length. This last-named fish is most extensively taken, and consumed either fresh or dried. It is mostly caught in Shikoku; when dried, it may be kept for several years; it is this fish which is denominated in the statistics referred to before as dried fish (*Katsuobushi*), the quantity of which amounts to about five millions of caties every year.

As to fresh-water fish, carp, eels, sly-silurus (*Namasu*), and Ahyu of the smelt family are most *recherché;* while the consumption of eels which are caught either in the sea or in fresh water—fresh-water eels being preferred—must be something enormous, as in Tokio there are thousands of restaurants called Eel-houses, where this fish is principally served. Herrings and salmon are chiefly fished in Yeso, and dried or smoked on the spot, as the difficulty of transport to the capital prevents their being sent there fresh; hence, fresh salmon is very seldom seen in the market of Tokio. Sardines reach the capital fresh, and are consumed largely in that state; but not only are they sent dried, but they are also greatly used for manure.

As to the quantity of whales caught in Japanese water, I m unable to give a statement, for want of information;

not only is oil extracted from this fish, but its bones are used for different purposes; and it is also eaten in Japan when dried, although in small quantities, its taste rather resembling meat than fish.

Glue and wax, as exhibited in our Court in the Fisheries Exhibition, are also made from the skin and intestines of different fish, through chemical process. Besides all these and other kinds of fish, different sorts of sea-weeds are very largely consumed as eatables in Japan.

It will be of peculiar interest to know that there exists in our country a sea-fish called Fugu, belonging to the order of *Tetrodons*, which is generally known to be very poisonous. In some localities the sale of this fish is strictly prohibited; but there are different kinds, some of which are said not to be poisonous. As this fish is of peculiarly pleasant taste, the lower class of people are often tempted to eat it. There is a proverb which says: "Fugu wa Kui tashi Iñochi wa oshishi" ("Great is the temptation to eat Fugu, but greater is the dread of losing life"). This shows how agreeable its taste is, and how poisonous it is to those who eat it.

V.—MODE OF FISHING.

Fish are caught either by nets, lines or other gear, according to their nature and kind. Nets are a little different, according to the localities where fishing is pursued. I shall endeavour to give some idea of the cod-fish, bream, mackerel fishing, and that of some other fish.

Nets are seldom used for catching cod; it is generally caught with lines. This fishery principally flourishes in the Northern sea, beginning from the 37th degree of latitude, therefore mostly on the coasts of the Island of Yeso, where generally five fishermen in a boat take with them 50 or 60 stout lines made with hemp, each line being from 160 to 200 yards long. To each line about 50 branch lines are attached at the interval of every 5 feet, and at the end of these, hooks are fixed. Lead is attached to both ends of the lines, and 3 buoys are fixed to it. Sardines or herrings, fresh or salted, are used for bait. The cod-fishing season, though it varies according to localities, lasts generally from December to March. The time for fishing is generally from 6 A.M. to 3 P.M., but this varies, of course, according to weather and tide. In the north the average quantity of one day's fishing is about 460 cod-fish per boat. In the Eastern sea the mode is a little different; it is conducted by 3 or 4 men in a boat, and the average fish caught is no more than 70 or 80 a day. Northern fishermen appear to be more skilful, in spite of rough and often stormy seas. I must not omit to mention that cuttle-fish is generally used for a bait for cod-fish in the Eastern fisheries.

Sea-bream is generally caught by trawl-nets, but line-fishing is nevertheless employed to some extent. The line for sea-bream is generally 2100 yards in length, and at the distance of every 2 yards a branch line, 4 yards long, is attached with a hook at the end. It is thrown into the sea at sun-rise, with crabs or other molluscs for bait, and every 2 or 3 hours it is taken out.

As to the mackerel-fishing, it is pursued at night; a number of boats sail in the evening and anchor where it is likely mackerel would flock. The fishermen also attract them by the use of torches, and catch them by hand-lines, using for bait sardines, or some other small fresh fish.

The mode of catching the octopus is very curious. A long cord of several miles in length is laid at the bottom of the sea, and branch lines, one or two yards long, are attached at intervals of 2 yards; at the end of each line, old shells, or bamboo cut in the form of pots, are hung down. The octopus is generally attached to rocks or some other objects, in order to protect its soft head; so that it finds these pots a very comfortable home, and gets inside and holds them strongly with its feet. Generally the cords are left for 6 or 7 days, and then they are taken up with pots-full of octopus, which, being of a very timid nature, stick closely in them, believing that they are in the safest place. In this manner the small kind of this fish is caught on the south and east coasts of Japan.

Tunny fish, and katsuo of the same family, are taken by rod and line. The boats for catching the latter kind of fish are generally strongly built, and manned by 8 or 10 men. When attracted by fresh sardines thrown into the sea by fishermen, they flock in great quantities, and then they are caught with artificial fish as bait. It is said that this fish is so easily and extensively caught, that young fishermen even forget that the boat would sink from being overladen with several tons of fish; there is therefore one old patron on board. When he thinks enough has been taken, he gives the order to his younger fellows to stop. Whale-fishing is performed with harpoons by numerous fishermen in several boats, pursuing the animal several miles off the coast. This mode of taking them seems to be general in the Japanese sea; but in Kagoshima, they pursue it into the bay, and then capture it with nets.

I am enabled to give the above statement concerning octopus and katsuo fishing, owing to the information kindly furnished me by Mr. K. Nabeshima, a student in London, who not only lived among the fisherfolk of Hizen, but is also himself a great fisherman.

As to the practice of throwing nets, which are known in

Japan by the name of *To-Ami* and which, are very largely used either in sea or fresh-water fishing, I leave it to be explained by a most elaborately prepared note kindly furnished by Mr. K. Nabeshima, and which will be found in the Appendix, p. 215. It may be worth mentioning that there exists in the eastern and southern coasts of Japan a class of women-divers, whose calling is to catch sea-weeds and shell-fish, especially sea-ear. Those who are familiar with Japanese pictures cannot help being struck with those representing beautiful women with red bathing-dresses, some diving into the rough sea and others coming out from the water, holding some shell-fish in their hands. But the women-divers actually engaged may not have such a mermaid–like beauty as represented in the pictures. However, their bravery and skill are very well known in Japan.

Those who have travelled in the interior, especially in Tokaïdo, may no doubt have remarked these divers; it is sometimes very amusing and refreshing after a fatiguing journey, to pass a couple of hours at the place where we alight on the sea-coast, looking at the divers, who will catch you shell-fish if you give them some recompense. At first, travellers are very much struck with the skill of these divers, who, according to the reward promised, bring shell-fish of different sizes. But they may discover afterwards that the divers had collected different sizes of shell-fish beforehand, and know very well what kind of these to choose, according to the amount of reward they should receive. Though this is only for the pleasure of curious travellers, not the real calling of the professional divers, still this fact shows to what a large extent this diving class of fisheries is carried on in Japan.

As to the fresh-water fishing, rod and line, nets and different kinds of implements are used. Fresh-water fish culture has existed from olden times, and especially that of carp; fresh-water bream, oyster, and gold-fish have also been extensively cultivated. It was only some years ago that the special attention of the government, as well as that of private individuals, was directed to the importance of salmon culture, and that of some other fish; and new scientific methods have been applied to it, and appear to be very successful.

In order to show what pleasure we take in fishing, it will be as well to mention the existence of private fishing ponds, besides river fishery in Tokio. In the suburbs of the capital some private individuals cultivate different kinds of fish in their ponds, and sometimes each pond contains fish differing either in nature or size. Any one is permitted to fish in one of these ponds, on paying entrance fees for the hour or day. I am informed that in some places ponds are classified according to the amount and quality of fish they contain; the entrance fee differs according to this classification. Therefore any one who, however skilful he may be in fishing, hopes by paying a small fee to catch many big fish in one of these ponds is greatly mistaken, because in the inferior ponds only small and worthless fish are kept.

As to the hooks and nets, I may point out that our hooks, both small and large, have a very sharp barb (though some have not, according to the fish to be caught); it is difficult to ascertain when it was invented, but at any rate this would prove our skill in fishing industry to have existed from ancient times. Lines and nets which are made of hemp, or other strong coarse material (and sometimes of silk), are generally varnished with the juice extracted from unripe persimons (fruit called kaki), in order to give them strength, and the power of resisting water; English nets are usually tanned. It would be very interesting if, after a careful examination, this stuff should also be made use of in this country for preserving nets and lines; and on the other hand, if the persimon fruit were condensed by some chemical process, Japan could supply it easily for the use of the British fisheries, and a mutual advantage might be derived from the transaction.

Fish preserved in tin are principally prepared in Hokkaïdo (Yezo); some specimens, such as oiled sardines, preserved oysters and tunny-fish, are exhibited in our Court. This branch of industry, being introduced only a few years ago, may require some improvement in preparation, in order to be more in accordance with European taste; with such improvements Japan may be able to meet a demand for these articles from abroad.

VI.—FISH COOKERY.

Cookery of fish is almost an art in Japan; the way of cooking is manifold. It may be divided roughly into several classes:—1. Raw fish, which is subdivided into two; the first mode is raw fish, properly so-called, that is to say, the flesh of the fish is cut in thin slices and arranged on the plate very neatly in the form of waves, sometimes without taking the skin off the fish, according to its kind, and it is served with sauce (shoyu), mashed raw turnips, horse-radish, and generally some fresh vegetables cut in small pieces and sea-weed. In the second mode it is called Araï (washed), because the flesh being cut in small slices, is washed with fresh water till it shrinks and gets harder. Sometimes two or three different sorts of fish of different olours are arranged on the same plate, and divided into red and white, which gives them a beautiful appearance. 2. Grilled. 3. Stewed. 4. Grilled with sauce. 5. Grilled first and stewed afterwards. 6. Mashed and boiled, prepared like sausages, which has a different name, according to its divers forms and manner of preparation. The inferior kind is made of shark's flesh and that of some other fish; the most *recherché* is made with bream and lobster.

This general classification may be again subdivided into several modes; it may even be said that there are as many varieties of fish cooking as there are different kinds of fish; and it may seem almost inconceivable to the English mind. how neatly, prettily, and with what genius and excellent taste this branch of cookery is conducted in our country. Any one who has been present at a Japanese dinner cannot fail to be struck with the good arrangement with which the different kinds of dishes are prepared; a dozen dishes, almost all made of fish, are differently cooked and arranged with vegetables and accessories. Sometimes we are puzzled to guess with what sort of fish the dishes are prepared; and this shows by what ingenious hands they have been composed. The dish most in vogue is composed of eels grilled with sauce. In England eels are cut in small pieces, and generally stewed or fried; but in Japan they are, while alive, cut into two along the back, but leaving the skin attached, and the bones are taken away, so as to leave skin and flesh, when they are prepared. With what quickness, skill and dexterity this part of their preparation is executed in the eel-houses is almost inconceivable. The man who does this work does no other part of the cooking; another man prepares them with bamboo skewers for being grilled; a third man does the next part of the work, and so forth; there is a real division of labour.

We must not omit to mention that a great quantity of fish and all kinds of molluscs are used for soup, and very often eaten with vinegar and some greens and sea-weeds. The most essential element of our cookery of either fish or vegetables is the sauce known here under the name of Japanese shoya, properly called *shoyu*, which is extracted from beans and koji; hard dried fish is also greatly used. This dried fish is cut into small slices and used for the preparation of sauce, or put over shell-fish soused in vinegar. This gives such a flavour to the fresh fish and vegetables that its use becomes almost indispensable to our cookery.

It must not be supposed that fresh fish can be obtained, and consumed with equal facility in every part of Japan; some tracts being very mountainous, the inhabitants of this region in the remote part of the interior are far from seaports, and generally are a class of peasant farmers, who live on rice or other cereals and vegetables only, being deprived, through the difficulty of transport, of the means of procuring fresh fish. It is true there are railways, but only a few lines connect three chief towns with a few seaports. Fish transport is generally effected by water, and then by carts or men-carriers. In spite of these difficulties of transport, a large amount of fish is consumed generally, because in my opinion, (1) the Japanese seas abound in fish, (2) our fisher folks are very skilful in the fishing industry, (3) the process of drying and salting fish is well conducted, (4) the fish cooking art is so developed that those who can, depend upon fish only. This last case must not be overlooked, because a great demand for fish (besides its cheapness) depends on the taste and liking of the people. In England, fish is often boiled simply, which takes away the best part of its flavour, and with whatever well-prepared sauce it may be taken, it is not so delicious as when prepared otherwise. England, having inexhaustible sea-fishing ground, with 114,000 active British fishermen, and above all with good transport, is more advantageously placed than Japan, yet the consumption of fish is comparatively small. The chief cause of this (putting aside the dearness of fish and other causes) seems to me, the way of cooking, which it is so desirable to have improved so as to increase the demand of fish consumers, and it would be worth while to try to study the Japanese fish-cooking art, in order to adopt it in this country.

As to the case of Japan, a great many improvements in fish-culture, industry, and for the easier transport of fish may be required. When the great line of railway from the capital to the north, which is in the course of construction by a Japanese Company, is completed, it will, I am sure, give more facility for the transport of the sea-products of Yeso, and increase its fishing industry in no small degree. In conclusion, the best means to improve national fish-industry is by the way of exchanging different views and information through the channel afforded by the International Fisheries Exhibition, which will doubtless be for the benefit of every party interested in this branch of national and international wealth.

DISCUSSION.

Mr. **Wilmot** (Commissioner for Canada) moved a vote of thanks to Mr. Okoshi, for the very lucid and interesting Paper he had read, and which he was sure, when printed and circulated, would prove of very great benefit. It taught him, who lived at the antipodes almost of Japan, that they there had their ideas in regard to preserving, cooking, and utilising fish quite beyond the conception of

Canada, or even England. The multitude of fish which were taken in the Japanese waters appeared to be very great, the population was very great, and consequently they wished to utilise fish in every way. He was somewhat amused to hear that they consumed the devil-fish, or cuttle-fish, which he was sure the people in this country or Canada would not think of touching. It was evident, however, that it was an article of food, and showed him that almost every description of animal extant in the waters was intended for the food of man, and it was only on account of prejudice that some kinds were not eaten. He had no doubt the time would come when it would be used elsewhere, especially after it was shown in this Paper that it was a useful food. Another thing which struck him was that the females in Japan engaged in fishing operations ; in this country when they went to the bathing ground in their bright-coloured dresses, it was more for the purpose of becoming fishers of men. If the Japanese custom were introduced here, no doubt many more fish would be taken.

Mr. J. C. BLOOMFIELD seconded the vote of thanks. He said that he unfortunately was an Irishman, and as such had a very doleful tale to tell when he came to think of the difference of civilisation between Japan and Ireland. This Paper said that in Japan the most was made already of one of the greatest gifts God had ever given to man, the great harvest of the sea, which took very little trouble on the part of either rulers or people to make the most of; but in his unfortunate country they had at present over 2500 miles of unfished coast, and about 527,000 acres of inland waters which did not contribute, except the salmonidæ, a five-pound note in value to the national food. It appeared that the Japanese were so determined to get the fish, that they took the female sex into partnership in their efforts; but in

Ireland many poor women during a great portion of last winter had to obtain sustenance for themselves and families from a kind of seaweed called dilex, which they found upon the rocks. He trusted that this glorious Exhibition, which had, by the friction of intellect, struck that spark which swept away many prejudices, would in the end bring all things to one common level of humanity throughout the world, and would then bring to his poor country some of the knowledge and some of the good results which must happen if only the present state of things in Japan was fairly considered. Many years ago, when he was in the Chinese seas, at the time England was guarded by wooden walls, it happened that a seventy-four ship was greatly infested with rats, and a grand rat-catching business took place, the rats were thrown overboard; but there was not a small boat within reach that did not cast off their anchors, and in a very short time the rats were devoured. Thousands of these Chinamen were now scattered all over the earth, so many were coming to some places that the law was stopping them. At that time he had never seen the Japanese; but in a very short time afterwards they saw that there was a necessity for them to learn of Western Europe, and at the same time it turned out that they had conferred great benefits upon Europe in their turn.

The vote of thanks was carried unanimously, and briefly acknowledged by Mr. OKOSHI.

Mr. STUART LANE then moved a vote of thanks to the Chairman. He himself had had great personal relations with Japan, which made the country familiar and interesting to him, and he could assure them all that the more they studied it the more they would learn to admire it. There was great similarity between Japan and Great Britain, both countries being nearly in the same latitude, and having about the same acreage and population, and each country might learn a great deal from the other. The pleasure they had all experienced in listening to the lecturer must be one greatly enhanced by the fact of the meeting being presided over by a Japanese; probably it was the first time such a thing had happened, but he was sure it would not be the last, for when once the Japanese took a thing in hand they never left it until they made it successful. He had had the honour of knowing both the Chairman and the lecturer for some considerable time, but he might say that when he met the latter, four or five years ago, on his arrival from Japan, he could not speak one word of English.

Mr. BEADON seconded the vote of thanks, which was carried unanimously.

The CHAIRMAN, in responding, said they were all aware that Japan had adopted many branches of Western civilisation in addition to her own, which had existed for centuries, and that she had made of recent years very great progress. Since the present Government came to power it had been their earnest desire to promote, amongst other things, friendship with foreign nations, and with this object they had accredited their ambassadors and other diplomatic representatives to the various courts of the world; and when there was any undertaking of an international character, such as the present Exhibition, whether in Europe or in America, they never failed to take an active part in it. It was a source of great satisfaction to them that the courtesy and respect they had thus shown to foreign nations had been cordially reciprocated, and that they had received assurances of friendship in return; but there was one serious obstacle which had tended to check this friendship—he alluded to the great delay which had taken place in the negotiations for a revision of the treaties proposed by Japan some years ago. Those treaties were concluded between Japan and the foreign countries some twenty-five or thirty years ago under considerable external pressure, and when the Japanese negotiators were totally ignorant of the commercial and other usages of Western countries. Treaties concluded under such circumstances naturally lacked that equitable character which was at all times so essential in any arrangement entered into between friendly powers. Japan in 1883 was very different to what she was thirty years ago, and the experience of thirty years amply showed that it was absolutely necessary to introduce certain modifications in the existing treaty arrangements. Those he was addressing might not attach much importance to this question, as it concerned a country so far distant, and no one not so thoroughly acquainted as he was with the general condition of Japan could properly estimate the serious difficulty occasioned by this disastrous delay in connection with the national finances and the attitude of the people towards foreigners. He sincerely hoped that the good feelings of the Western powers would induce them to recognise not only the necessity, but also the advantage of speedily bringing about a satisfactory conclusion of this question. In conclusion, he must say he regretted that Japan had not been able to take a more lively part in this Exhibition, but it so happened that they had a National Fisheries Exhibition in Japan this year, and naturally the Government had to give considerable attention and assistance to that, which had prevented their sending a larger quantity of specimens to England. Japan, as a great fish-eating country, had naturally done her utmost to develop the fishing industry, and he should not be exaggerating when he said that it had attained such an extent that

36,000,000 of people were to-day more or less dependent on fish as food; and had it not been for the coincident Exhibition held in Tokio, she would have been represented in the same grand manner as she had on previous occasions of a similar international character. At all events Japan had readily come forward to take part in this Exhibition, and had thus fulfilled her international obligations, at the same time showing her usual courtesy and respect to the British Government and British public.

APPENDIX A.

"93, TALBOT ROAD, BAYSWATER, W.,
"20th *August*, 1883.

"DEAR SIR,—In accordance with your request, I have much pleasure in furnishing you with a few notes on 'Toami' (throwing-net), embracing a description of its mode of use, and an account of its construction.

"I also enclose herein a short Paper on 'Ahyu' and 'Namako,' fish which are much esteemed in our country.

"I beg to express the hope that these communications may be, in some way, serviceable to your purpose.

"I am, Sir,
"Yours faithfully,
"K. NABESHIMA.

"N. OKOSHI, Esq.
"Japanese Consulate,
"London, E.C."

"TOAMI."

(THROWING-NET).

Among the many kinds of fishing appliances in Japan, the one called "Toami" is probably the most novel to Europeans, and at the same time, the most interesting to the Japanese.

"Toami," as above translated, is a throwing-net, and its structure may be thus described.

The net and size of its mesh varies in magnitude, according to the size and nature of the fish to be caught, and the loc where it may be used. Its length varies from 5 to 7 yards, and it is conical in shape, becoming larger and larger from the apex downwards to the foot; where, when fully extended, it measures from 7 to 9 yards in diameter.

To the top of this cone-shaped net is tied a "hand rope," about 6 or 8 yards, having at the other end a loop.

At the foot of the net is attached all round the extremity, a strong "foot-rope," or "ground-rope," to which numerous metal weights, as sinkers, of peculiar shape, named "iwa," are fastened.

These sinkers are made of a mixture of lead and tin. In shape they resemble the handle of an ordinary travelling trunk, having a hole at each end, through which the "foot-rope" is passed at intervals equal to their own length, generally from 2½ to 3 inches.

The edge of the foot of the net is then doubled or folded inwards upon itself—on the side opposite to that of the rope tied to the apex of the cone—to the extent of about one-tenth of the length, and is then fastened to the meshes all round, at intervals of from 20 to 30 meshes, according to the size of the net.

The effect of this is to make a kind of continuous sack or bag termed "Tana" all round the inside of the net. The *modus operandi* may be described as follows:—

The fisherman standing up in the bow of his boat first makes a running knot with the loop, which he secures round his left wrist.

With his right hand he then coils the rope into his left, until the upper portion of the net is drawn into his grasp, leaving about a yard or more hanging down. He then passes a part of the latter over the left elbow, maintaining it there by keeping his arm at right angles to his side, and so allowing the net to swing in a pendent form.

Then, gathering into the grasp of the right hand about half of the remainder, he swings the whole to and fro, to give it impetus, and dexterously throws it some 8 or 10 yards in front of his boat, in such a manner that it is extended into a complete circle when it falls into the water, where it quickly sinks in its regular cone-like shape to the bottom.

After it has remained there a few seconds, the line is pulled gently in different directions, so that the weighted portions trail along the ground and approach each other, until the net is gradually and finally closed (great care being observed that no outlet of escape is afforded between the ground and the sinkers). The fish which may be enveloped in the toils endeavour to escape, and as openings of the "Tana" appear to them to be loopholes for this purpose, they eagerly enter them, and are effectually confined. The net is then drawn up slowly from the ground, until it hangs perpendicularly: and as the sinkers now almost cling together, all egress from the sack is thoroughly barred. The fisherman gradually hauls it up, and as the "Tana" begins to approach the surface, he rapidly but gently swings it with its piscine contents into the boat.

The method of constructing this net presents some difficulty, as it must be cone-shaped. The knot which unites the meshes is not the "hitch-knot" which is prevalent in Europe, but the "reef-knot," which is particularly suited to nets of this description.

The process of netting is generally commenced from the lower part, or the "foot" of the net. The number of meshes in the first row varies from about four hundred to seven or eight hundred, and the size of each mesh varies inversely to its number. The greater the size of mesh, the less its number, and *vice versâ*. For instance, to construct the "Toami" for catching mullet, suppose the number of meshes in the first row to be 400, and the size of each mesh to be 1½ inch square (using a flat spool of 1½ inch in width); well then, this row of 400 meshes must be continued successively 25 times; the 26th row must be lessened by 16 meshes, by attaching two meshes together at the intervals of every 25 meshes in that row.

Now there will remain 384 meshes, which, being netted again successively 15 times, must again be decreased by 19, by attaching 2 meshes together as before, at the intervals of every 20 meshes in that row. This process will be best shown in the following scheme.

THE SCHEME OF CALCULATION.

Part.	Number of Meshes.	Decrease of Meshes.	Number of Rows.	Size of Flat Spool.	Feet.	Inches.
1	400	16	25	1½	3	1½
2	384	19	15	,,	1	10½
3	365	18	10	,,	1	3
4	347	17	10	,,	1	3
5	330	16	8	,,	1	0
6	314	17	8	,,	1	0
7	297	16	8	,,	1	0
8	281	15	8	,,	1	0
9	266	16	7	,,	..	10½
10	250	17	6	,,	..	9
11	233	16	6	,,	..	9
12	217	16	6	,,	..	9
13	201	16	5	,,	..	7½
14	185	16	4	,,	..	6
15	169	16	4	,,	..	6
16	153	19	4	,,	..	6
17	134	22	3	,,	..	4½
18	112	19	3	,,	..	4½
19	93	23	3	,,	..	4½
20	70	23	2	,,	..	3
21	47	15	2	,,	..	3
22	32	2	2	,,	..	3
23	30	..	1	,,	..	1½
Total.	..	..	152	..	10	0

Nets in Japan are dipped in shibu (the juice of unripe persimon fruit). In my humble opinion they are by this process rendered, for several reasons, far superior to those which in Europe are subjected to that of tanning. For instance, the treatment with shibu produces a greater amount of stiffness in nets and prevents their tendency to swell when in the water, thereby ensuring a great rapidity of sinking. Moreover, as a preservative from decay and the bad effect of salt-water, this treatment is invaluable.

"AHYU."

The fish called "Ahyu" possesses some very peculiar characteristics. It varies in size from about 6 to 12 inches, and inhabits fresh and rapid streams, having a nature like that of the salmon in making its way up to the highest sources of the rivers in the spring, and betaking itself in the autumn to the estuaries to spawn. Strange to say, the parent fish, after depositing its ova, disappears, most probably dying. Hence it is sometimes called the "one-year-fish." When taken from the water, it does not at all emit a fish-like odour, but a smell remarkably resembling that of the cucumber. It is not tenacious of life when taken out of water; indeed, the slightest handling is immediately fatal to it. Its flesh is held in the highest estimation, and is considered the most delicately flavoured of all river fish. Its scales are almost invisible, and the body resembles the European smelt. Its lips are somewhat thick, being either golden or silver in hue, those of the former colour being most esteemed. It rapidly deteriorates in flavour, and cannot be conveyed far in a fresh and proper state. Hence it is somewhat expensive.

Three modes of taking "Ahyu" are in vogue, which we may thus specify:

Firstly: the "Toami" or "Throwing-net" (as above described) is most successfully practised.

Secondly: cormorants are used. This plan is too well known to need any explanation.

Thirdly: the fish are captured in a species of trap, termed "Yana," during the autumn, when they are migrating downwards in large numbers to the estuaries for spawning. This method will need some elucidation.

At a convenient place the river is dammed by two structures composed of fascines and stones, running from the banks at opposite points towards the middle, at an obtuse angle down the stream, without meeting, but leaving a space of 4 to 5 yards, through which the current is forced to run at a high speed. In this narrow passage is fixed a contrivance composed of a large number of bamboos, not bound together quite closely, but connected so as to fill this narrow space, diagonally tilted downward towards the stream in such a manner that, while it receives the rapid fall of water, it, at the same time, detains the fish, the water escaping through the interstices between the bamboos, which, however, are not large enough to allow the fish to pass through. In this manner enormous quantities are caught during the season.

"NAMAKO."

(BÊCHE DE MER).

Namako (which is the Japanese for the Sea-Slug or *Bêche de mer*) somewhat resembles in shape the half of a melon cut lengthwise. It is styled in the reports of the Japanese Customs "Kinko"—the name given to it when dried—and is exported to some foreign countries. Its colour is greenish-gray, dotted with raised spots of light yellow, which colour also pervades underneath, where it attaches itself to the rocks or stones. It is eyeless, and boneless, its digestive organs being very small. It is found on various parts of the coasts, and is much sought for as an article of food. Its usual size, when quiescent and not extended, is 6 to 12 inches in length, its general breadth being about 2 to 4 inches. It is capable of elongating and contracting itself at pleasure. To ensure the capture of "Namako," calm weather and clear water are essential, so that the fisherman, as he slowly and quietly paddles here and there, may discern the object of his search at the bottom. Armed with a long bamboo rod from 18 to 24 feet long, which is tipped at the extremity with an iron-barbed spear-head, he leans over the gunwale of his boat, closely peering and prying down into the clear water with keen and practised eye. When he discovers the fish, he proceeds forthwith to spear and secure it. To assist his power of vision, he adopts a peculiar

He has, in the boat, a tiny vessel containing oil, from

kes, from time to time, a small quantity, and drops it on the surface of the sea. This arrangement enables him to see the bottom so clearly, that he has little difficulty in spying down with success, even when the water is somewhat deep. The fish is generally eaten uncooked, cut into thin slices, with vinegar. In a dry and prepared state it is conveyed into the interior or is exported.

This fish has an excessively strong antipathy to rice-straw, so much so that the fish actually dissolves into a liquid if it should come in close proximity to it, just as a piece of ice melts under the influence of the sun. Sometimes disagreeable effects are produced by too free an indulgence in partaking of "Namako," and to counteract these symptoms the liquor in which some rice-straw has been boiled proves an effectual antidote.

NEWFOUNDLAND:

ITS

FISHERIES AND GENERAL RESOURCES.

BY

THE HONOURABLE SIR AMBROSE SHEA, K.C.M.G.,
COMMISSIONER FOR NEWFOUNDLAND TO THE INTERNATIONAL
FISHERIES EXHIBITION.

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CONFERENCE ON OCTOBER 24TH, 1883.

Mr. FUNG YIH, Secretary of the Chinese Legation in London, in the Chair.

ON NEWFOUNDLAND: ITS FISHERIES AND RESOURCES IN CONNECTION THEREWITH.

MR. CHAIRMAN,—Up to a recent period the colony of Newfoundland, which I represent, has occupied a singularly paradoxical position. It is the oldest and nearest of England's colonial possessions, and yet is in the mother country the least known of them all, and the subject of confused ideas regarding climate, social condition, and general characteristics. From time to time stories of more or less accuracy or fulness of description, regarding historical and general events, have appeared, but have not attracted to any extent the attention of the British public, nor have they materially assisted in diffusing information or removing injurious impressions, which have for so long a period placed the colony in a false position.

Recently, however, the subject has been taken in hand by earnest and able pens. In a work published early in the present year, the Rev. M. Harvey, of St. John's, Newfoundland, and Mr. Joseph Hatton, of London, have, in co-operation, bestowed a long-deferred justice upon the island, and, in a clear and masterly manner, have set forth its claims as to climate, soil, and general resources. Thus the colony has at length been brought into rightful prominence, and, due justice having been done its famous fisheries and their exhaustless supply, it has become a public fact that we possess in addition other stores of wealth in the hitherto neglected interior, where there are sources of industry and wealth which promise to reward the enterprise it must attract when opened up by the railway in course of construction under the auspices of the Newfoundland Government.

The colony possesses a strange and eventful history. From its discovery in 1497 it has gone through every conceivable vicissitude of disputed possession and claims for sovereignty. A century passed after its discovery ere England concerned herself with the island, nor did she then share to any extent in the fisheries, which were prosecuted chiefly by Portuguese and the fishermen of the Basque provinces. In 1578 some four hundred vessels were employed in the cod fishery. Of these seven-eighths were French, Spanish, and Portuguese, England owning but fifty of the total. No attempt was made at this period to colonise the island. The fishermen resorted to the coast at the beginning of the season, and returned to their several countries on the approach of winter. This long-continued indifference of the English Government to the value of Newfoundland was at length brought to a close, in the reign of Queen Elizabeth, by the enterprise and decided action of Sir Humphry Gilbert, a knight of Devonshire. In 1583, in the presence of men of various nationalities whom he had summoned to meet him, the knight read a commission from the Queen, authorising him to take possession of the island in her name. This was the first act of declared sovereignty; but it was not followed by any immediate efforts at settlement. No doubt this was in a great degree owing to the death of Sir Humphry Gilbert, which took place soon after the annexation to the crown.

Subsequent attempts to colonise were fitful and ineffective. While the sovereignty was *de jure* in England, the French were busily engaged in planting fishing settlements on the coast. Indeed, at the present period, the fishing ports, smaller harbours, and bays of the island are a *mélange* of corrupted French and Portuguese nomenclature. For many years a bitter struggle existed between French and English for the mastery of the island. This frequently resulted in serious conflicts, in which the former were rarely even temporarily successful. Notwithstanding these disasters, the French managed to retain a hold over a portion of the coast, and to this day, owing to the supineness of the home Government, possess certain rights upon "the French shore." In 1762, the French made their last organised attempt to obtain possession of Newfoundland; and, owing to treachery and the surprise of sudden attack, were for a time successful, but the arrival of British troops resulted in their disastrous defeat, and effectually established the since unquestioned right of British sovereignty. But, even after the removal of these obstacles to settlement, the anti-social policy, which controlled Government and commercial operations for more than half a century of undisturbed British rule, was not less repressive. In short, these two agencies worked together in remarkable combination of intolerance. This wretched policy was, about the year 1820, terminated by the establishment of regularly constituted courts of law. Prior to that period, the administration of miscalled justice had been in the hands of whatever captain of English man-of-war happened to be, for the season, on the coast.

In 1832, representative government was granted to the colony, and with it came the concomitant important steps towards progress and improvement. These have since developed into a settled policy, under which our self-governing population are asserting their rights to bring the colony within the pale of advancing civilisation.

THE COD FISHERY.

The cod fishery, from the discovery of the island, has been and still continues to be the main element of its resources; nor are there at this day any symptoms of exhaustion. Seasons vary in productiveness, and unfavourable returns have sometimes extended over a course of years, and have raised questions as to whether the supply was not in course of diminution. But such speculations have always so far been ended by the return of abundant fisheries, showing that as far as Newfoundland is concerned, the cause of "short catches" lay in reasons apart from the failure of the species.

Notwithstanding the use of these fisheries for so many centuries, the present season has witnessed as large a catch as was ever known, and this fact undoubtedly furnishes an answer to all questions as to the "exhaustion of the cod" on the Newfoundland coast. As a rule our cod fisheries begin in June and end in October, the most productive months being June and July, when the coast is visited by a small fish called the "caplin," specimens of which are exhibited in the Newfoundland Court of this International es Exhibition. This fish, which somewhat resembles the American "smelt," swarms on all parts of the coast, to which it resorts to spawn about the middle of June, in almost unlimited quantity. It is then that the cod, attracted by the caplin, is found along the shore in its greatest abundance. The caplin supplies the bait for that portion of the fishing which is carried on with hook and line, the other modes of capture being by means of a trap —a specimen of which is exhibited at the Fisheries Exhibition—and a cod-seine, which is a net from one hundred to one hundred and twenty fathoms long, having a depth varying from fifty to one hundred feet in the centre, but narrowing towards the extremities. This seine is swept round a body of fish, and drawn together. The foot is then hauled up, enclosing very often forty or fifty tons weight of fish. Fixed cod-nets are also used to some extent, while the degree of success which attends the different methods is a varying and uncertain condition, neither being sufficiently assured to warrant its absolute and exclusive application.

The coast-line for Newfoundland proper covers an extent of two thousand miles, exclusive of Labrador, on which the colony possesses one thousand miles of fishing ground. Here the fishing population is migratory. Those of our people who resort to Labrador go there in June and return in October, the residents, whose lives are spent in a primitive and unambitious manner, being a very small number.

The cure of the fish requires much care and judgment, the weather being a very important factor in the operation. Unbroken sunshine is not desirable, while a long continuation of wet produces deterioration of quality; the best cure is effected when the weather is variable. It is not more necessary that the fish should be exposed to the sun to dry than that it should be piled and left in bulks to be gradually matured. Hence the reason for varying weather being desirable.

The quantity of dried codfish produced during a season averages 75,000 to 80,000 tons per annum. The value aggregates about a million and a quarter sterling, while the present season will probably exhibit an increase of from sixteen to twenty per cent. on this amount. The cured fish is exported to Brazil, Spain, Portugal, Italy, the West Indies, and a small quantity come to England. I shall, in the course of this Paper, endeavour to show why this small quantity should be increased, and with how much advantage to consumers in this country.

THE SEAL FISHERY.

The next of our productions in point of importance is the seal fishery, which is well illustrated in the Newfoundland Court of the Exhibition. This fishery formerly employed some four hundred vessels, varying from eighty to one hundred and fifty tons, requiring the services of about fourteen thousand men. The introduction of steam has changed all that, and the fishery is now carried on by about twenty-five steamers—not more than thirty or forty sailing vessels remaining, through the obvious impossibility of effective competition. The pursuit of this fishery is of far more recent date than that of the cod. We find that at the end of the last century the whole catch was but about five thousand seals per annum. It continued to increase, and in 1820 there were over two hundred thousand taken. Winds and ice conditions have a regulating effect on the success of the voyage, and the results show a most important variation. Thus in 1844, 685,000 seals were taken; in 1860, 444,000; in 1872, 278,000; in 1882, 156,000 —the smallest on record; while in the present year the catch is about 400,000.

We know that winds and ice play an important part in the prosecution of the sealing voyage; but there is a strong conflict of opinion as to whether the species is not diminishing in quantity. The falling-off of the catch of late years is probably, in some degree at least, ascribable to this cause, and hence has arisen the serious question whether some measures of restriction may not be applied with advantage. At present the only regulating law is one which restrains steamers from proceeding on their voyage before the 10th of March, while sailing vessels may leave port on the first. About the 1st of March the seal brings forth its young upon the ice-fields. The young seal, which is the most eagerly sought after, is matured for commercial use about the 20th of March, when the skin and fat, separated from the carcase, has a weight of fully forty pounds. If taken about the 10th or 12th, the weight is not over twelve or fourteen pounds. It is to prevent the taking of immature seals, and the consequent loss, that steamers are kept back, thus preventing their premature appearance on the scene of slaughter. When winds prevail from the shore, and keep the ice slack, a ship can travel more or less at discretion, and the result on the whole is then a success. A prevalence of east wind generally blocks the coast, and packs the ice in the surrounding seas, so that at the critical period between the 15th and the end of March, should this condition of things prevail, the ships are imprisoned, and the issue is a losing one. It sometimes happens that ships are fortunately jammed amidst multitudes of seals, and then they obtain their full fares without chance of competition from those outside. As many as twelve or fifteen thousand a day are often secured by those favoured with this exceptional opportunity.

In the case of sailing vessels, the men had half the gross receipts of the voyage for their share. But, owing to the greater cost of steamers, and their expensive outfit, the men's share is now reduced to one-third.

The steamers are from three to six hundred tons burthen—wood built, full timbered, with hold beams, heavily planked, sheathed, and thoroughly equipped to endure severe trials in the ice floes. They cost from twelve to twenty thousand pounds, or even more, and, as they can only be employed profitably during the short period of the seal fishery, which rarely occupies more than two months, and as this has been proved a business of chequered success, it cannot be contended that the investment is one of large attraction. To the people of the colony the substitution of steam for sailing vessels has proved a loss; the quantity taken has not at least shown any increase on the average of former times, while the men's share has been greatly diminished. Moreover, the sailing vessels were in a large degree the property of resident "planters," whose earnings helped to swell the common wealth, while now the ownership has passed into the hands of large capitalists, some of whom live abroad, and, in the nature of things, their means cannot play the same important part in promoting the social well-being of the colony.

When successful, the sealers sometimes return in two or three weeks. The seals—or rather the skin and fat, the carcase being left on the ice—are quickly landed, and the one separated from the other by a process termed skinning. The fat is then cut up, placed in a manufactory, and tried out by steam, the result being the pure, colourless, and tasteless oil, of which samples are exhibited in our collection. The skins are salted, and in due time shipped to England, where they are manufactured into leather, being split by machinery into leaves of various thicknesses, and recently, through the enterprise of Messrs. Stephen and Son, of Dundee, several descriptions of leather have been produced, which meet the wants of bookbinders and upholsterers as well as the former purpose of shoe-leather, to which, until recently, the Newfoundland sealskin was exclusively applied. The exceptional superiority of these various descriptions of leather is proved by a Gold Medal being awarded for them.

The value of this item of the productions of the colony shows an average of about £230,000 per annum. The men employed in the industry number about ten thousand. They are the flower of the labouring population, and amongst them it is not easy to find a man over forty years of age. For skill, daring, and power of endurance, it would be difficult to match them anywhere, and but for the obstacle arising out of the distance of the colony from this country, we should probably have had a batch of these fine fellows brought over to see and to be seen, without any fear that they would suffer by comparison with the fishermen of this kingdom, whose presence during the Exhibition has been such an appropriate and gratifying feature of this magnificent display.

THE HERRING FISHERY.

Following in importance to the seal comes the herring fishery. The supply of this fish is very large, especially on the south-west coast, where, during the winter and spring months, a material amount of business is done, a large portion of the fish being sent to the United States in a frozen condition. It is not a rich fish, nor has it been turned to as much account as it might be as a cured article of export. What we prize most in this branch of the trade is the Labrador herring, which for size and nutritious properties is superior to any that the resources of the world have given to the Fisheries Exhibition. This fishery is rarely ever followed as a separate pursuit. Herrings usually appear in August, and are seldom found on the coast after September. The fishing is attended to by the cod-fishermen as an adjunct to "the fishery," as the cod-fishing alone is termed. I may here note incidentally that we have a local legal decision that salmon is not fish!—a condition which, however paradoxical it may seem, was conventionally correct, for it had relation to a charter for a fish cargo, which locally was understood to be codfish, and which the offer to ship salmon did not satisfy. For various reasons the herring fishery has not expanded into the proportions it seems capable of attaining, but this is probably because cod-fishing offers superior attractions. The annual value is about £140,000. Herrings are taken in mesh nets and in seines. As many as two thousand barrels have been enclosed in one haul of the seine. When taken in such large quantities the cure is often inferior, from the difficulty of saving the fish in good time. Net fishing is more regular and satisfactory. The United States and Canada receive the larger portion of the catch of Labrador herrings. They should undoubtedly be known more extensively here, and their excellence would give them a high place in the fish-food market.

LOBSTER AND SALMON FISHING.

Lobsters have received some attention during the past few years, and the export of canned lobsters to this country, to which they are almost wholly sent, amounts to over £20,000. This fish will decidedly need the application of some conservative measures, for it already gives signs of exhaustion which it would be wise to regard. The high quality of the Newfoundland lobsters has secured for them the only gold medal given for this fish by the jurors at the present Exhibition, and the local Government will no doubt direct its attention to the means by which to guard this promising industry against strains beyond its capacity.

Salmon are found in greater or less quantities all around the coast, the finest being those taken at Labrador. In quality these are equal to any in the world. This fishery is carried on for purely commercial purposes, and nets are the means of its prosecution. June and July are our salmon-fishing months, and one rarely sees the fish at any other time. In addition to fish consumed in the colony the catch averages 4000 tierces of 300 lbs. each, salted, packed and sent chiefly to American markets, where they are sold for from £6 to £7 per tierce.

The fish offal has not hitherto been turned to account, beyond what was used by the fishermen and small farmers for their limited crops, but during the present year Job Brothers, and Co., Newfoundland and Liverpool merchants, have established some expensive factories for the manufacture of fish guano; and, as it will be so much reclaimed from waste, we may hope the adventure will become permanent and profitable.

The above enumeration exhausts the category of those fisheries that enter into the commerce of the colony. The whole value has reached a million and three-quarters sterling per annum hitherto; and this year it will not be far short of two millions.

The resources of the colony are not confined to its fish produce, as has been the prevailing impression. Already, within a period of twenty years, copper mining has grown to a degree which makes Newfoundland rank as fifth in the list of copper-exporting countries of the world. As the growth and outcome of these industries the colony has an annual import and export trade of over three millions sterling, and the stable character of the commerce of the colony, based upon its fisheries, is well illustrated and substantiated by the fact that two local banks, possessing an aggregate capital of less than one hundred and fifty thousand pounds, supply all banking facilities required for its trade. We have in this statement evidence of the soundness of our trade, and the absence of speculative element. The cases are rare in which so small an amount of borrowed money has a place in the business capital of a country, while even in the banks the merchants are large stock-holders. Nowhere do business men exhibit higher integrity in their transactions; and, in all those countries with which they have relations, the reputation of a Newfoundland merchant is second to none for those qualities which inspire confidence and respect. Failures of any consequence are so rare that they scarcely have a place in the estimate of contingencies; and it is largely due to this satisfactory condition of affairs that we find the stock of our oldest local bank commanding a price of six hundred and fifty per cent. on its original cost— a speculative value, but for the purpose of *bonâ fide* stment. The stock is not in the market, and can only sionally be obtained. The stock of the other and younger bank is worth three hundred per cent. when it changes hands, which is not a case of frequent occurrence.

Newfoundland merchants have found their way into the higher commercial and public life of England. A late governor (and for a long time director) of the Bank of England, Mr. Thomas Newman Hunt, is a Newfoundland merchant, whose house has borne an honoured name in the colony for more than a century. Nor is the colony unknown in the annals of the British Parliament. Some years since Mr. George Robinson, a Newfoundland merchant, sat for Worcester; and later, within the past few years, Mr. James Johnston Grieve represented Greenock, as one of those able, painstaking business men, whose effective, though unostentatious, labours have so large a share in the valuable work of Parliament. Mr. Grieve's retirement was a purely optional act, and he is succeeded by another eminent Newfoundland merchant, Mr. James Stewart, who also fills a highly useful and recognised position in the councils of this nation.

POPULATION, REVENUE, ETC.

The population of Newfoundland is about two hundred thousand, chiefly descendants of English, Irish, and Scotch. They are a hardy and enterprising community, inheriting the qualities of their progenitors. The Government is the same as that of other self-governing colonies, and works well. The revenue is derived wholly from imports, and the duties are levied for revenue purposes alone. It produces about £220,000 per annum, which is expended on civil administration, roads, lighthouses, telegraphs, &c. The administration of public affairs is sound in an exemplary degree, sallies of local opposition critics to the contrary notwithstanding.

The colony is practically free from debt, the amount it owes, about £250,000, being covered by reserves. If necessary every obligation could be promptly discharged. The savings bank, a Government institution, holds £300,000 sterling, the saved earnings of fishermen, on which three per cent. interest is allowed. I may here observe that an amount of fishermen's earnings almost equal to the sum in the savings bank is lodged in the other banks of the colony at the same rate of interest. The Government securities bear interest at the rate of four per cent. They are entirely confined to purposes of local investment, the colony never having borrowed from outside sources.

NECESSITY FOR EXTENDED EMPLOYMENT, AND MEANS FOR THIS PURPOSE; THE RAILROAD, ETC.

The state of things thus described was not, however without its seasons in which suffering was experienced owing to failures of the fisheries more or less extensive, and the hazards of relying on the single pursuit were often severely illustrated; and at best the state of the colony wanted those elements and conditions of advancement which form a main attraction of colonial life. The time had fully come when those charged with the administration of affairs felt that a policy of progress had become indispensable. Education was doing its work, and gave the people aspirations beyond the normal condition of a fishing community. Newfoundland is too near the fast-growing United States and Canada to retain its population, if they were left much in the rear of these countries in social conditions and in regard to future prospects. It became a question then as to whether we should institute a policy of improvement at home, or make the people feel that they must seek to satisfy their higher aspirations abroad. The Government thereupon decided upon the only course which a consideration of all the circumstances rationally warranted. The fisheries always left at some portions of the year a time of enforced idleness, and, with a population chafing under "the laborious lassitude of having nothing to do," it became an imperative demand that this evil should be terminated as speedily as possible. The benefits of new industries had been felt to some extent, but the growing requirements of an increasing population claimed the application of a vigorous and well-directed policy, which would bring the resources of the island into fuller and more adequate development. From scientific reports no doubt remains that copper and lead are present in large quantities in several parts of the island. In these products a large field of labour is to be found, while, without claiming the highest place for our agricultural capabilities, we possess large stretches of country, where operations may be carried on with remunerative results.

The island has an area of forty-five thousand square miles, many parts being well wooded, and much intersected with water. We do not regard the soil as adaptable to the successful growth of wheat; but for pasture purposes it offers advantages of no mean order, whilst all root vegetables attain a high degree of perfection, and we have had our experience only on the coast, where climate and soil are both less favourable than what exists in the interior of the island. It is an error to suppose that we are wrapped in perpetual fogs. No doubt we have these unpleasant visitations, but they are the exception, and not the rule;

and even these are less known in the interior than on the coast. From a record kept by a gentleman who spent some time in the country, many years ago, on an adventurous mission, we find forty-one bright days, eight rainy, and four foggy, and this might be assumed as the probable experience of our inland life. June, July, August, and September, are our summer months, when we have a temperature of 65° to 80° Eahrenheit, and during which vegetation proceeds rapidly. The season would be longer in the interior, and where east winds have less effect. Winter really begins in December and ends in May. The temperature rarely goes below zero, the normal state being from twenty to ten above that point, The climate is specially healthy, and the appearance of the people is an eloquent testimony to this fact.

Such is a short review of the economic and social condition with which the Government had to deal, and it met them with wisdom and effect. The construction of a railroad to open up the means of conveyance for new industries was the manifest work to be undertaken, and it was entered on, in the year 1881, by contract with a company, who agreed to build and operate three hundred and fifty miles road for a subsidy of £40,000 per annum, together with five thousand acres of land for every mile of road constructed. Considering the cogent reasons that sustain the wisdom of this measure, it will seem strange to learn that it met with bitter resistance from some of the merchants, from whose minds the traditional idea of Newfoundland as a purely fishing station had not been wholly removed. But a general election having come on in 1882, the policy of the Government was endorsed by the return of twenty-seven against six members, and this pronouncement showed what the people felt and intended. So emphatic an expression could not be without its effect in forcing the opponents to inquire into the reasons which led to it; and we are witnessing the usual result of such reflection on the part of business men, who rarely persist in impracticable courses, while in the present instance a calm consideration of the facts must show that merchants must be gainers by an increase in the earning power of the labouring man. The satisfactory results of the working of the forty-five miles of road already in operation have also had their effect in producing the practical withdrawal of opposition, and no Government would now be possible in the colony that did not make railway progress a cardinal principle of action. The inducements to the company, besides the subsidy, are the business of the resident population along the road, with the large traffic that must reasonably be expected from the new population that will be attracted by the homes offered on the lands the road will open up; and as it will pass through fertile stretches and timber districts, as well as valuable mineral belts, which are all available for the claims of the company, the prospects are such as should entitle the enterprise to take a good place in the category of promising *bonâ fide* business undertakings. In harmony with the spirit that promoted the railway is that which led to the establishment of a graving-dock at St. John's, the capital, and which will accommodate the largest vessels of the Atlantic fleet. The position of the port in the route of the trade between Europe and America, making it an unrivalled harbour of refuge, gives this dock a place of high importance to the transatlantic trade, and underwriters will not be slow to recognise its value. It will be completed and ready for work by the end of 1884, and is being built by Messrs. J. E. Simpson and Co., of New York, whose docks are taking so high a place for their applicability to cold climates. This enterprise is the work of the local Government, on whose account it is being constructed.

Newfoundland has hitherto been little more than a geographical expression to most people in this country, but we may now hope for a change in this respect, in the interests of truth, and for that correct understanding the people of this country would naturally wish for regarding the oldest of the dependencies of the Crown. The representation of the colony at the Exhibition must have tended to this result, and have established the claims of Newfoundland, commercially and otherwise, to distinctive and intelligent appreciation.

I would here state that the leading object of this great enterprise—to place a fuller and cheaper supply of fish within reach of the people of this country—cannot be more effectively advanced than by bringing Newfoundland within the limits of the sources from which supplies are drawn. The dried codfish of the colony has been adjudged the first place, for all samples exhibited, and gold medals have been accordingly awarded to them all. Its excellence therefore cannot be questioned, and with good cooking few dishes are more acceptable. The average price of fresh cod to the consumer in this country is about sixpence per pound; and as it requires two pounds and three-quarters of fresh fish to make a pound of dried fish, the relative value of the latter would be about sixteen-pence per pound. In the process of cure no appreciable portion of the valuable properties of the fish is removed; and when I can state that this dried fish can be supplied for a fourth of its clear relative value as compared with fresh fish, as here stated, a case is placed before the people of this country which they have great interest in earnestly considering. At present about 3000 tons of this dried fish finds its way to England, while 75,000 tons are sent to Brazil, Spain, Portugal, Italy, and the West Indies. In the four first-named places it is subject to a duty of from 25 to 40 per cent., and yet it has become a necessary food, prized by rich as well as poor. In this country, of course, it is free from taxation. I may observe that, in point of nutrition, dried cod-fish is as nine to ten in comparison with beef.

Another article which is of great hygienic importance figures in our category, and has obtained the highest approval of the jury. I refer to cod-liver oil, on which the award is unqualified, placing our whole collective exhibit in the front rank. This forms a subject of serious consideration for the public, who have a vital interest in avoiding remedial agents of a doubtful character; and the lesson contained in the decision of the jurors is one they cannot disregard. This award is not the expression of interested men whose motives might be questioned; and when the jury give to the cod-liver oil of Newfoundland the distinguished place established by their report, their decision must carry with it all that authority attaching to a body of high character and special competency intrusted with duties in which the interests involved demanded the most careful and conscientious examination.

On our oils generally the jury have made the following statement: "The above, forming an extensive assortment of the various descriptions of fish oils, are superior to any other exhibit of the kind in the Exhibition." This gives them a declared value over any similar productions in the world, which the laws of trade will not fail to regulate.

I have now to avail myself of the opportunity afforded me, to offer to the Executive Committee my hearty congratulations on the splendid success of this Exhibition, which owes so much to their unselfish and ceaseless labours, ably and wisely directed, and for which they will find their best reward in the good they have accomplished. But self-denying and effective though their labours have been, they will be the first to recognise the leading importance of the influence of H.R.H. the Prince of Wales, by which the people were drawn into co-operation with, and support of this great undertaking. Here we cannot fail to think regretfully of the great and good Prince Consort, with whom these international assemblies had their origin, and the grandeur of whose broad and well-balanced intelligence was but imperfectly known to the world until after the end of his pure and earnest existence. His daily life showed how royalty could find its highest uses in sympathetic and thoughtful endeavours to mitigate the trials and brighten the lives of those whose lot it is to toil; and H.R.H. the Prince of Wales has worthily accepted the inheritance in his devotion to works like the present, which aim at the broadest diffusion of welfare and happiness. In this noble exercise of his influence he is laying broad and deep the foundations of his exalted position in the hearts and convictions of the people, and presenting a spectacle that all well-wishers for the permanence of our matchless institutions must regard with feelings of gratified assurance and profound satisfaction.

DISCUSSION.

Mr. **SAYER** proposed a vote of thanks to Sir Ambrose Shea for his very valuable paper. He said there was not much dried cod used in this country, because we were supplied so well with fresh cod. We used to get fish off Ramsgate and Margate, but now we had to go nearly to the coast of Norway for it, and there was no doubt the time would come when English fishermen would have to make their way to Newfoundland, and perhaps even to America. There was no town in the world so well supplied with fish as London, as was shown by the fact that Mr. Hewitt supplied Billingsgate with 13,000 tons of fresh fish, at a cost of 1⅓*d.* per lb. He had no doubt there was an opening in Newfoundland for English merchants, and he hoped the time would come when the Labrador herring would be brought to the London market. The nets formerly employed had a mesh of twenty-eight to the yard, but they were used now forty to the yard, the result of which was that immature fish were caught, and fishermen had to go farther and farther off.

Mr. **WILMOT**, in seconding the motion, said it afforded him great pleasure to find that the adjoining colony to his own took such a prominent part in the Exhibition, and he hoped the time would arrive when his friend Sir Ambrose Shea would come to the conclusion that it was advisable not to stay out in the cold, but to join the Canadian confederation. Had the two colonies been united, they would have stood foremost in the world for the exhibit of fish. No one was better fitted to prepare a Paper on this subject than Sir Ambrose Shea, who had been identified with Newfoundland for a long time, and who recently had a title conferred upon him by Her Majesty, which was esteemed an honour by all the colonies. Mr. Sayer had referred to the possibility of England having to go to Newfoundland or Canada, or America, for some portion of her fish supply. It had been his object throughout to press the importance of protecting the fisheries of this country, and he was glad to find that Mr. Sayer held the view that England had, in an improper and wanton manner, destroyed the fish round the coast. This had been brought about by the avarice of the fishermen not being checked by the Government. He would not dilate further upon this topic, but he could not express too strongly his sense of the want of some protection being afforded to the fish.

The resolution was carried unanimously.

Captain CURTIS, R.N., said he noticed that Newfoundland was not a free trade colony, the whole of her revenue being obtained from import duties. He wished, however, to draw attention to the question of fish offal. Some thirty or forty years ago his father anticipated that the supply of guano would fail, and manufactured several tons of fish manure by mixing the offal with charred peat. In Newfoundland there was plenty of peat, and by mixing it with the offal a very valuable manure might be formed. He had lately become acquainted with a gentleman, Mr. Johnson, who was making 200 tons of fish manure per month, and getting from £8 to £11 per ton for it, the works being carried on at Belvedere, below Woolwich, and he hoped some of the Commissioners would take the opportunity of visiting the works. There was no nuisance whatever connected with the manufacture; the offal and
gs of fish was put into tanks at Billingsgate, and
into barges and discharged into receptacles, where it
sintegrated and dried by superheated system; and

it was a remarkable fact that the men who went to the works from a hospital, far gone in consumption, had become quite strong and healthy there. In fact, the only complaint the men made was that their appetites became too good.

Sir AMBROSE SHEA, in returning thanks, said he regarded it as a great privilege to have the opportunity of addressing an English audience. At the same time he did not admit that he was a stranger, because the colonists claimed to be as loyal as any men under the sun. With regard to the observation just made, he might remark that during the past year attention had been given in Newfoundland to the subject, and a considerable quantity of fish guano had been made, and it was very likely that in future the offal would be brought into more general use. He quite agreed with Captain Curtis as to the importance of turning it to a profitable account.

Mr. HERBERT HOUNSELL said he could speak from practical experience of the value of fish manure, and he thought it one of the most important features of the fisheries of the future. Twenty-five years ago he was director of a company formed in the west of Ireland, called the Fishing and Fish Manure Company, the scheme being not only to fish, but to pay Irishmen for fishing and for the refuse fish. Every time the trawl was hauled on board there was a large portion, amounting to 60 or 70 per cent., wasted, being either smothered or of uneatable kinds, or too small for the market. The whole of this was thrown overboard, and in many cases fouled the breeding-places. Their scheme was to encourage the fishermen to bring this to shore, where it could be converted into manure. As far as the theory could be carried out it was successful, but unfortunately, through the inertia of Irishmen, they could not get a supply of fish, and eventually the company collapsed. Some time afterwards Mr. Hewitt started the idea of giving the fishermen in the North Sea a bonus for bringing home the offal, and started a factory below Barking, where this was boiled and mixed with a certain amount of charcoal to fix the ammonia. He (Mr. Hounsell) purchased a cargo of this and took it to Dorsetshire; a portion he employed in growing mangel wurzel, and gained the first prize at the show, and the remainder he sold to farmers at £14 to £15 a ton.

Mr. SAYER said the idea of the Executive Committee when this Exhibition was got up, was to augment the supply and lessen the cost of edible fish to the public; they had no idea of turning fish into manure, but of getting a large supply to London, so as to cheapen it. When he was placed upon the Committee, he suggested the first thing to do was to educate the people to eat those fish which were thrown overboard; he said they might cook these fish in the Exhibition, and show the people that plaice, ling, haddock, coal-fish and cod were as good as soles and salmon. He was at first met with some opposition, and asked if he wanted to turn the Exhibition into a fried-fish shop; but his idea was carried out, and he hoped that one consequence would be to educate the public not only to eat soles and salmon, which were so expensive, but also to eat these common kinds of fish, which were so abundant in Newfoundland, in America, and sometimes on our own coast.

Mr. MACKIE said it was one thing to cook fish which were now destroyed by the trawls, and another thing to make good use of offal which was now wasted. Newfoundland seemed to be peculiarly a fishing station in which there was an absence of waste fish of the small kind, and the prosperity of the island might be said to be based on fishing, and it appeared that this must continue to be the case in the future. It seemed to be unique in this respect, and also in the fact that other industries had been there developed in order to employ fishermen at times when they could not pursue their usual calling.

Mr. WILMOT then proposed a vote of thanks to the Chairman, which was carried unanimously.

THE SWEDISH FISHERIES.

BY

PROFESSOR F. A. SMITT,

ROYAL COMMISSIONER FOR SWEDEN TO THE INTERNATIONAL
FISHERIES EXHIBITION.

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CONFERENCE ON THURSDAY, JULY 5, 1883.

LORD EDMOND FITZMAURICE, M.P., in the Chair.

THE SWEDISH FISHERIES.

THE CHAIRMAN, in opening the proceedings, said the object of this meeting was to have the pleasure of listening to Papers read by the delegates of foreign countries, who had kindly come to attend this International Exhibition, an Exhibition which had attracted the attention not merely of the inhabitants of this country, but of those of nearly all the nations of the civilised world. He had hoped that the chair to-day would have been taken by Lord Granville; it was unfortunately impossible for him to be present as he had wished, but he had his permission to state—as it was hardly necessary for him to state—that he took the greatest interest in this Exhibition, and considered it to be of very great importance. Lord Granville had great experience on these subjects, having been one of the Commissioners of the great Exhibition of 1851, when he believed it was universally recognised that there was hardly any one to whose exertions the success of that Exhibition was more due, Lord Granville being at that time Vice-President of the Board of Trade, and taking very great interest in all questions connected with that department. This Exhibition was not a general, but a special one, and the gentlemen who had come to this country having a special knowledge of these subjects, had many of them attended previous Conferences in other countries on various fishery questions, of which they at the Foreign Office heard a great deal, because fisheries had not unfrequently been the cause of international difficulties and disputes. He had recently seen a statement to the effect that fish diet exercised a very cooling effect on those who used it, and that if people really wanted to be well, especially in warm weather, they should eat fish. He sometimes thought, at the Foreign Office, that perhaps fishermen did not eat fish themselves, and that some of these fishery disputes of which they heard there, and which gave them a great deal of trouble, might be settled if they were to suggest to the fishermen that they should all eat the fish which they caught; perhaps then they would not engage in those disputes on the high seas which very frequently gave the Foreign Office of this and other countries a deal of trouble. Having thrown out this suggestion, he would call upon Mr. Davey to read the first Paper, which was in the name of Professor Smitt, the delegate of Sweden, who did not consider himself sufficiently familiar with the English language to read it himself. He should also add that, owing to the number of Papers dealing with these foreign fisheries, some of them would have to be adjourned to a future occasion.

The Paper was as follows:—

During the last seventy years Sweden has enjoyed, under its present line of sovereigns, profound peace, and the exhortation of one of its poets, "to replace lost Finland within the boundary of Sweden," has been the device of the country. And, indeed, it has made great progress towards that aim. In the arts and sciences the names of Swedish men have more than once vied successfully with those of the most illustrious of their contemporaries. But a Berzelius and a Nordenskjöld have shown the practical tendency of Swedish science, such as indeed it should be in a country where the necessity of turning the natural resources to profit is so great, and where scientific research may be said, in a great part, to have taken its rise from the teachings of Linnæus. At the beginning of our century Sweden was poor and exhausted. Altogether regenerated since that time, it now presents the spectacle of a flourishing and well-cultivated country.

In the midst of this general progress, one branch of Swedish industry has, however, remained far behind. The Swedish fisheries are as yet far from what they naturally ought to be, viz. one of the most important trades of the country. If, however, not a little has been achieved, this is no more than ought to be expected in the country where modern fish-culture, based on the experience of natural history, has one of its most important sources in an essay on the cultivation of spring-spawning fishes, written by Mr. Lund, alderman in Linköping, and published in 1761, in the 'Transactions of the Royal Swedish Academy of Sciences.'

From the time of Linnæus, viz., in 1766, Sweden had inherited a Fishery Law, the terms of which, even at the present day, might serve as a model of what the aim and regulations of any well-directed fishing industry should be. But political changes and the modern development of manufactures and trade made a revision of this Fishery Law necessary; and in 1852 the present Fishery Law was promulgated, which has essentially retained the terms of the preceding one. Thus the development of the Swedish fisheries has, for a long time back, been directed by regulations founded on the results of scientific research and on the actual knowledge possessed at the time regarding the life and habits of the fishes.

Two circumstances have, however, deeply influenced this development: one when, in the province of Bohus, on the western coast of Sweden, in the beginning of the present century, a herring-fishery richer than any other, as it seemed, suddenly disappeared, leaving after it only poverty and distress. The measures taken by the Government were then directed towards the encouragement of other sea-fisheries, and Swedish fishing vessels went to the banks west of Skagen (the reef of Jutland), and further to Jäderen and to Storeggen, off the coast of Norway, where the Swedes showed the Norwegians the way to a difficult but profitable occupation. It is only within the last few years (since 1877) that the herring has again commenced to find its way, in immense shoals, in amongst the rocky islands near the coast of Bohuslän. However, the fish does not come in there until the greater part of the shoals have spawned outside, and the object of the Government has, therefore, been to promote those modes of fishing by which the herring is caught on the open sea and while it is still in the very best condition. In this matter, Scotland has lent a helping hand to Sweden. A large number of Scotch drift-nets, ordered partly for the Government and partly for private persons, have been employed in this herring fishery; and Scotch curers and smokers have, by private enterprise, been sent to Bohuslän.

The other circumstance which has been of the greatest importance to the development of the Swedish fisheries is the improvement of the means of communication, namely the introducing of railways during the last thirty years. It will be easily understood of what consequence this has been to a country like Sweden, whose extent is so large in comparison with the thinly scattered population, because, through this means and by the aid of the present improved method of preservation, even fresh fish from Sweden can find a market abroad.

We see from these facts that the Swedish fisheries may anticipate a promising future, and it is, therefore, to be hoped that the approximate calculation given below of the yearly revenue of these fisheries, as compiled under my direction by the Fishery Assistant, Mr. Trybom, may only be a provisional one, especially as the statistical reports on the Swedish fisheries are very scanty and incomplete. It may be of value, however, as indicating what Sweden at present has to show in this respect.

A. *The Herring and Sprat Fisheries. Calculation of the revenue of the herring fisheries on the Swedish shore of the Baltic, and in the Sound (Oresund), compiled by Dr. R. Lundberg, Inspector of Fisheries* :—

Year.	Statements collected by	Government District.	Swedish Barrels.	Swedish Crowns=Kr.
1870	Byström, Fishery Assistant . .	Norrbotten	3,202 at 15 kr.	48,030 calculated.
1870	Ditto	Vesterbotten	8,805 „ 15 „	132,075 „
1870	Vahlberg, Fishery Assistant . .	Vester Norrland . .	21,759 „ 15 „	326,385 „
1881	Bergius, Inspector of Fisheries .	Gefleborg .	12,738	239,006
1881	Lagerholm, Sub-Inspector of Fisheries . .	Upsala . .	5,742	87,547
1870	Vahlberg . . .	Stockholm .	10,372 „ 15 „	155,580 „
..	.. ..	Södermanland	..	..
1880	Vahlberg . . .	Östergötland	4,196	65,775
1880	Ditto	Kalmar . .	6,459	108,215
1881	A. Flygare and A. Persson . . .	Blekinge .	62,391	392,175
1881	Inspector of Fisheries . .	Kristianstad	11,370	145,205*
1881	Ditto	Malmöhns .	25,750	495,986†
1869	Rev. Dr. Th. J. A. Lyth . . .	Gotland .	29,815 „ 15 „	447,225
		Total amount	202,599	2,634,264

* The average for the last four years (1878–81) = 157,682 kr.

† The average for the last three years (1879–81) = 373,894 kr.

Dr. Lundberg in his report makes the following remarks :—

"The above calculation, being based upon reports from different years, some of which are quite old, cannot of course pretend to be complete, but it seems to me that all merit ought not justly to be denied it, as, in spite of its deficiencies, it gives an approximate idea of the value of this fishery, which cannot accurately be calculated from the reports hitherto obtained.

"A difficulty in making this estimate is caused by the different measures by which the fish is sold in different places. In the central and southern part of Sweden the greater part of the catch is sold fresh (by the 'val,' or batch of eighty fishes), while in the northern parts of the country it is salted and sold by the barrel. In order to calculate the quantity of fish caught a reduction must be made to one or other of these measures. The reductions are here made to barrels by computing the number of 'valar' (fourscore) of salt fish usually contained in a barrel. This number varies however, not only in different years but in different parts of the same governmental district. Where the statements have not been given in barrels, the following table has been used :—

	Score per Barrel.
"For the district of Gefleborg (48 'valar' =)	192
" " " Ostergötland . . } (30 'valar' =) .	120
" " " Kalmar and Blekinge }	
" " " Kristianstad (25 'valar' =) . . .	100
" " " Malmöhus (24 " =) . . .	96

"As to the price given in the table, this has either been estimated or is directly furnished by the various col-
rs. For the Government districts of Malmöhus and
inge the revenue for the years given in the table was
e the average, but for the other districts it may be

safely assumed that the revenue is stated rather too low than too high."

As the amount just mentioned—2,634,264 kr.—does not include the value of the herring fishery of the district of Södermanland, the yearly revenue of this fishery on the coasts of the Baltic and the Sound (Oresund) may be estimated in round numbers at 2,650,000 kr.

According to the latest obtainable yearly reports of the Fishery Inspector of the Government district of Gothenburg and Bohus, the value of herrings and sprats caught in this district in 1880 was 354,298 kr., and for the years since that time the amount might probably be doubled.

When, finally, to this is added the value of the herring fishery of Halland, which in 1881 was estimated at "fully 60,000 crowns," the revenue of the herring and sprat fisheries of the whole country may be estimated in round numbers at 3,065,000 kr.

B. *The revenue of the Salmon Fisheries of Sweden during the year* 1881, *according to the statistics received:—*

—	Weight in Ltt.*	Gross Income. Crowns.	Remarks.
a. In the rivers—			
Torne elf . . .	6,548	67,584	
Kalix elf . . .	293	2,514	
Ume elf	2,104	18,168	Of these 240 Ltt. (4,800 tt.) salt.
Öre elf	109	818	
Ljusne elf . . .	3,358	30,481	
Dalelfven (as far as Söderfors) . .	5,210	42,529	Of which 41,138 kr. from the Elfkarleby fisheries.
Motala Ström . .	589	6,480	
Emån	250	2,770	Of which 1,600 tt. smoked, worth 1,450 kr.
Mörrums ån . . .	1,020	15,220	This is the revenue of the state fisheries. The private fisheries of the hamlet of Mörrum are not included.
Helga ån (Yngsjöström)	120	1,680	
Lagan	2,518	44,875	
Nissan	183	3,660	Return from one fishery only.
Klarelfven . . .	3,571	32,062	
Norselfven . . .	29	270	
Jösseforsen . . .	622	6,200	
Gullspångselfven .	1,800	15,000	
b. Along the shores—			
The shore outside of Torne elf . . .	1,913	18,972	
The shore outside of Ume elf . . .	1,346	11,402	
Outside of the mouth of Laga ån . .	150	2,625	
Outside of the mouth the River Nissan .	1,392	27,840	Calculated by means of returns from salmon dealers and others in Halmstad.
The shores of the district of Kristianstad . . .	1,324	13,082	
The shore of the district of Malmöhus	331	4,596	
c. In the Wener . .	15,893	123,050	Returns from the part of the coast of the Wener belonging to the government district of Elfsborg are wanting.
Total . .	50,673	491,878	

---

* A Swedish Ltt. = 20 tt.; a Swedish tt. = 485 grammes.

Now as the value of the private fisheries of the hamlet or Mörrum has been estimated to amount to 10,000 kr., answering to about 667 Ltt. of salmon, this sum may be added to the preceding table. Returns from many salmon fisheries are, however, altogether wanting. The above stated amounts—50,673 Ltt. and 491,878 kr.—therefore in no wise indicate the whole amount of the revenues of our salmon fisheries during the year in question. By including the reports that are yet to be received from several rivers and coasts for the foregoing year, a more accurate account can be got out. The following figures may therefore be quoted:—

—	Year of Report.	Weight in Ltt.	Gross Income. Crowns.	Remarks.
Angermanelfven .	1880	..	..	Returns from a few fishermen only.
Indalselfven . .	1880	..	..	Returns from a few fishermen only.
Ljungan . . .	1880	..	..	Returns from six fishermen only.
Viskan . . .	1880	..	..	Returns from Åskloster.
The coast outside of the River Ångermanelfven .	1880	..	..	Returns not reliable.
Åtran . . .	1879	..	..	Returns from a few fishermen only.
Lule elf . . .	1878	..	..	Of these only 60 salted.
Råneå elf . . .	1878	..	..	
Pite elf . . .	1878	..	..	Returns from the fishery of Fällfors only. 80 Ltt. salted salmon.
Gideå elf . . .	1878	..	..	
Göta elf (above Nyebro) . .	1878	..	..	
The coast outside of Kalix elf .	1878	..	..	Of these 605 Ltt. salted salmon.
The coast outside of Gideå elf .	1878	..	..	
In the open sea outside of Blekinge	1878	..	..	
Total amount.	..	11,903	96,694	

Together with the returns for 1881, these last amounts, therefore, would show that the salmon fisheries of Sweden annually amount to 63,243 Ltt. with a value of 598,572 kr.

But not even these figures show the real extent of our salmon fisheries. As has been noticed in the remarks, the returns from many rivers and coasts are partly uncertain and partly incomplete, and from several salmon fisheries, on the coast of Pite, Skellefteelf, Gefle ån, the sea around Gotland, Rönneån, the Government district of Bohus, and that part of the Wener which belongs to the Government district of Elfsborg, no returns are to be had.

That those which are obtainable considerably fall short of the real value of the salmon fisheries of Sweden will also follow from a comparison with the same fisheries of the neighbouring country, Norway, the value of which is estimated by a reliable person at about 1,800,000 kr. The annual revenue of our salmon fisheries may therefore, without exaggeration, be estimated at 625,000 kr.

C. *The Eel Fishery with traps on the shores of the districts of Östergötland, Kalmar, and the western part of Blekinge and the coasts of Skåne.*

—	Years of the Reports.	Ltt. of Eel Caught.	Gross Income of the Fishery.
The government district of Östergötland . .	1880	2,835	17,010
„ „ Kalmar . . .	1880	4,650	27,900
„ „ Blekinge (western part) . . .	1881	1,830	12,450
„ „ Kristianstad . .	1881	4,924	35,445
„ „ Malmöhns . . .	1881	2,995	12,831
Total	..	17,234	105,636

The average gross income of this eel fishery on the ts of Skåne from 1879-81 was 91,287 kr. When it is dered that no reports have been obtained of the eel fisheries with traps from the Government district of Stockholm, the annual revenue of this entire fishery may safely be estimated at 150,000 kr.

D. *The Coast and Sea Fisheries*, with the exception of the fisheries cited above in A, B, and C.

Of this fishery there are returns only from the Government district of Bohus and from Skåne. In the district of Bohus it gave (together with the lobster and oyster fisheries, in 1880):—

	Kr.
A gross income of	1,339,480
In the district of Malmöhns in 1881	271,075
In the district of Kristianstad in 1881	37,506
In these three districts together . . .	1,648,061

Estimated at a low figure, the fishery in question in the other provinces along the coast may be supposed to yield an annual revenue of about 350,000 kr., or an amount that makes the annual revenue of these fisheries in the whole kingdom, in round numbers, 2,000,000 kr.

E. *The Lake and other Freshwater Fisheries.*

It is scarcely possible to find the approximate value of the lake fisheries of Sweden by the official returns now at hand, and it is also very difficult to obtain complete and reliable statistics with regard to them. The statements concerning our largest lakes, viz., the Wener, Wetter, and Mälar, are the most complete; but in regard to the first they are wanting from the Government district of Elfsborg; in regard to the Wetter, there are no returns from the Government districts of Östergötland and Örebro; and finally in regard to the Mälar, they are wanting from the Government district of Stockholm. In those parts of the above-named three lakes from which returns have been obtained, however, the fisheries have amounted to the sums shown by the following tables:—

—	The Reports are for the Year.	Value for the Draught.	Total Amounts for the Lakes.	Remarks.
The Wener—district of Wermland . .	1881	47,000	..	Approximately according to Ch. Thorkildsen.
District of Skaraborg .	1881	110,333	..	
			157,333	Without the salmon fishery.
The Wetter—district of Jönköping . . .	1881	20,000	..	
District of Skaraborg .	1881	51,149	..	
			71,149	
The Mälar—				
District of Nyköping .	1881	38,017	..	
„ Westerås .	1881	24,660	..	
„ Upsala . .	1881	54,388	..	
			117,665	
Total . .	..	..	346,147	

If, with the knowledge of the above stated figures, we should venture to estimate the fishery of the Wener, in the district of Elfsborg, at 25,000 kr., the fishery of the Wetter in the districts of Östergötland and Örebro, at 40,000 kr. and the fishery of the Mälar, in the districts of Stockholm, at 25,000 kr., or nearly the same value as is stated for the district of Westerås, the revenue of the fisheries of the three lakes would be the following :—

	Kr.
Of the Wener (without the salmon fishery). . . .	182,333
(Together with the salmon fishery 305,383).	
Of the Wetter	111,149
Of the Mälar	142,665
In the three lakes together (excepting the salmon fishery of the Wener).	436,147

Except from these, our three largest lakes, there are official statistics to be found respecting the lake and other fresh-water fisheries in :—

The government district of Kronoberg for the year	1872
„ „ Jönköping „	1873 and 1881
„ „ Östergötland „	1881 „ 1882
„ „ Westerås „	1874 „ 1881
„ „ Kopparberg „	1881
„ „ Gefleborg „	1881 and from that time.
The parish of Arjeploug for the year	1881

These returns are, however, all incomplete, as they only state the fisheries of a (larger or smaller) portion of the lakes in the respective districts, and because the value of the fisheries in the lakes stated has been estimated in round numbers, which are generally rather low. The reports from the Government districts of Östergötland and Jönköping are the most complete; these are the only ones from which a tolerably true idea of the real revenue of the fishery may be obtained. Within the former district 21,548 Ltt. were caught in 1881, and the value stated was 50,969 crowns. The statements are from the greater number, or at least from all the most important lakes in the district; not from the Wetter however; neither are the salmon or eel fisheries of Motala Ström (the river Motala) included. The latter consisted in the year mentioned of 1113 Ltt., worth 11,130 kr., in addition to which is the eel fishery of Motala "Kungsfiske," the average value of which in 1860-70 was estimated to 775 kr.

The lake fisheries in the Government district of Jönköping—that of the Wetter excluded—yielded in 1881, according to the statements received, 72,730 kr., an amount which, however, is probably considerably too low. Returns regarding the crayfish fisheries, for instance, are to be had only from five lakes, and the amount stated is only calculated at 6100 kr., although crayfish are stated by trustworthy persons to have been caught in the district to many times that amount.

It is true that these two districts are among those which have the greatest number of lakes; but when the united fisheries, calculated at a low rate, yield an annual revenue of 135,604 kr., that in our three largest lakes fish is caught to a value of 436,147 kr., all the remaining lake fisheries might be estimated at 2,428,249 kr., or the yearly revenue of the whole of our lake fisheries calculated at 3,000,000 kr.

As this sum, however—3,000,000 crowns—to a great extent is based only on estimates, it might be interesting to throw light on the real worth of these fisheries by means of the following calculations, made from some lakes in different parts of Sweden, from which statements in some degree reliable are to be had :—

—	Extent. Swedish Square Miles.	Gross Income of the Fishery in 1881.	Calculated by means of the foregoing. The Annual Gross Income	
			Of 1 Swed. Square Mile of Fishing Water would be	Of the Fishing Waters of the whole Kingdom 294·6 square miles (without the 4 great Lakes) would be
		Kr.	Kr.	Kr.
Lake Womb (district of Malmöhns)	0·1084	1,202	11,088	3,266,525
The Nömm (district of Jönköping)	0·1296	6,750	52,083	15,343,652
The Glan (district of Ostergötland)	0·6490	8,664	73,350	3,932,920
Lake Roxen „ „	0·8491	14,100	16,606	4,892,128
Lake Öje (district of Kopparberg)	0·1345	2,000	14,870	4,380,702
The Hornafva together with the Stornafva and Uddja (district of Norrbotten)	5·1742	5,095	985	290,181
The Boren (district of Östergötland)	0·2420	900	3,801	1,119,775

The average annual gross income of all the freshwater fisheries of Sweden, the three great lakes excepted, is therefore, according to these seven calculations, 4,746,553 kr.

Calculated according to the five of these lakes which lie in Götland (the twelve southern Government districts) the average gross income of one Swedish square mile of fishing water there is 22,360 kr. In these districts there are

54,753 square miles of freshwater,* the fisheries of which ought accordingly to yield an annual income of 1,224,277 kr.

In Svealand (the seven central districts) there are 54,336 square miles of fresh water. Calculating according to the returns from lake Öje, situated in this part, the annual gross income of these waters would be 807,976 kr.

In Norrland (the five northern Government districts), containing 185,524 square miles of fresh water—the annual gross income of these, calculated in accordance with the returns relating to the Hornafvan and the lakes connected with it, would amount to 182,731 kr., or together 2,214,984 kr.

The object in calculating these amounts—4,746,553 and 2,214,984 kr.—has only been to show that the 3,000,000 kr. which was before stated as the probable annual value of the freshwater fisheries of Sweden—the salmon fisheries excepted—was by no means too high.

The value of all the fisheries of Sweden, estimated approximately, but judging from all appearances by no means too high, should therefore amount to :—

	Kr.
A. For the herring and sprat fisheries	3,065,000
B. For the salmon fisheries	625,000
C. For the eel-fishery with traps on the coasts . .	150,000
D. For other coast and sea-fisheries	2,000,000
E. For the lake fishery	3,000,000
Total	8,840,000

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* The three great lakes are not included here.

NOTES

ON THE

FISH SUPPLY OF NORWAY.

BY

FREDRIK M. WALLEM,

EXECUTIVE COMMISSIONER FOR NORWAY TO THE INTERNATIONAL FISHERIES EXHIBITION.

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CONFERENCE ON THURSDAY, JULY 5TH, 1883.

LORD EDMUND FITZMAURICE, M.P., in the Chair.

NOTES ON THE FISH SUPPLY OF NORWAY.

ON a map called "The Fisheries Map of the British Islands," you will find a dotted line somewhere between Scotland and Norway. It proceeds from the ocean west of Ireland round the north of Scotland, crosses the North Sea and follows the south-eastern coast of Norway, and then turns back along the whole Norwegian coast. The line is only called "the 100 fathom line"! You may think the line indicates the limits of the British Fisheries, but that is not so; it only tells you where the water is 100 fathoms deep, and that the ocean at the north-eastern part of the North Sea, or off the Norwegian coast, is in some places still deeper; it has the shape of a narrow, long basin.

A closer investigation of depth would show, that similar basins extend in some places about one hundred miles into the country in Norway,[*] forming, in connection with

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[*] The longest basins or fjords on the West coast of Norway are:—

Hardangerfjord	100	kilomètres	long.
Sognefjord	145	,,	,,
Nordfjord	70	,,	,,
Trondhjemsfjord	135	,,	,,

Sognefjord is as well the longest as the deepest one, being about 690 fathoms deep.

the basin in the ocean, a set of warm water-belts, which keep the temperature in the sea as well as on shore very moderate, while ice covers land and sea almost everywhere else at the same geographical latitude; for instance, in Greenland and Siberia.

These warm-water basins in the Norwegian Ocean are of the greatest importance for the fauna and flora—for the life in the ocean as well as for the life on shore. In these basins live large shoals of cod and herring, and you might call them "the large feeding-ponds," in which the food from the western and northern parts of the Atlantic Ocean settles down, and where an abundance of all kinds of fish come together to find food—and feed upon each other.

The Norwegian fisheries are not carried on here or from the surface of these basins. Very few fishing vessels go out to "the feeding-ponds" or grounds to fish. Only when the cod, herring, caplin, and mackerel leave the deep water and go to the eastern edges of the basin to find suitable spawning places close to the shore in the dark winter time or the early spring, only then the shoals will come within the limits of the Norwegian fisheries.

As the fisheries, especially that of cod and that of winter herring, are carried on in the spawning season and when the water is moderately cold, the shoals coming in from the ocean are compact and enormous. The fishermen wait until the shoals come close up to their stations, and they are here able to catch large quantities from their small open boats, quantities that would be many times multiplied if the stormy days of winter did not interfere, so much that only half of the season can be used for fishing.

These winter fisheries, on the spawning-grounds of the cod and the herring, have been carried on certainly as far back as the history of Norway reaches, and that is more than a thousand years. We find that in olden times those parts of Norway were the richest and strongest, where the fisheries were most successful or easiest. The largest city in Norway, and in some respects the largest business place of Northern Europe, was that port, from which the largest quantities of fish-products were exported from Norway to Southern Europe. And only within the last fifty years, during which other industries have developed rapidly in Norway, and have grown larger than the fisheries, has the central station of business and industry of Norway been removed to another part of the country. But still the fisheries of Norway are of such importance for the country, that without them the population would fall perhaps 30 per cent., and large parts of the coast would have no inhabitants at all. More than 40 per cent, of Norway's exports are fish products.*

As, I suppose, it would be proper from this international platform to look upon the question of fisheries also as an international one, especially with regard to the fish supply of the world, or, in the present case, perhaps more distinctly with regard to the fish supply from the ocean and fishing grounds of the North Sea, I shall make a few remarks on this subject, without entering into a description of fishing, gear, boats etc.

The most important fisheries in Norway are that of cod and herring; and, as I mentioned before, the main fisheries are carried on in the spawning season, and on the

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	Millions Kroners.
* The export from Norway in 1881 was in all .	120·9
Fish products	50·2
Timber and wood	44·9
Other objects	25·8

very grounds where the fish spawns; some places even not farther from the huts of the fishermen than they can see the shoals arriving followed by whales and birds.

THE COD FISHERIES.

We can trace the large cod fishery of Lofoten as far back as a thousand years, although we cannot say how large it was in olden times. In these thousand years there has never been any fear that the enormous takes of spawning fishes would have any bad effect on the shoals. The places where the fishery is carried on are exclusively spawning places; scarcely any schools at all are to be found there during the rest of the year. The codfish, which come in from the deep basin from January to April, are nearly all of the uniform size of 10 or 11 lbs. weight alive,* and their errand seems always to be a first spawning-trip. The character of the coast, the vegetation of the sea around the islands is a most favourable one for codfish—and it would be difficult to find a more comfortable bed and home for the small codlings than the coast of Lofoten, and other spawning-places of Norway. The "climate" of the sea here must be very pleasant for all fishes, entering it for spawning purposes. The water is moderate all the year; no ice in the winter, no "dangerous" heat in summer, and besides that there

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* The weight and length of the codfish at Lofoten have been taken only lately; the returns for the year 1882, the average fish being not fat at all that year, show the following figures as average of about 200 fishes.

	Cod Caught by Long Line.		Cod Caught by Gill-net.	
Length . . .	83·0	centimetres.	87·0	centimetres.
Weight, round .	4·71	kilograms.	5·17	kilograms.
" split . .	2·59	"	3·00	"
The liver . . .	0·17	"	0·21	"
The roe . . .	0·35	"	0·50	"

is a very gradual change of temperature from the surface of the sea downwards, to give the fish a chance to find the most suitable temperature for the time. In winter, when the temperature of the air may be 10 to 12 degrees below freezing point, the water would be quite warm and comfortable (for a cod), and in summer, when the air and even the surface of the water is too hot for a fish, the water in the deep basins would be just as cold and pleasant as desirable for the shoals of cod and herring.

The following tables from the official returns will show the difference between the temperature of the air and that of the sea; also how small the changes of the temperature of the sea are during a year:—

In the Week ending	The Temperature of the Air, 1881. Centigrades at Svolvær.				The Temperature of the Water, 1881. Centigrades.						The Day and the Fishing Station.
	Average.		In the Course of the Week.		In the Surface.	10 fathoms below Surface.	30 fathoms below Surface.	50 fathoms below Surface.	80 fathoms below Surface.	90 fathoms below Surface.	
	At Noon.	Lowest Temp.	Highest.	Lowest.							
January 22	+7·2	+ 9·2	+3·9	+13·3	1·0	1·25	2·0	5·5	6·25	..	Svolvær, 29th January.
„ 29	+7·7	+11·3	0·0	+13·3	1·0	1·25	1·25	5·5	6·5	..	„ 3rd February.
February 5	+7·4	+11·1	+3·9	+12·8							
„ 12	+6·8	+10·9	+5·0	+13·9	0·75	1·0	5·0	5·0	..	..	„ 18th „
„ 19	1·2	+ 3·0	1·7	+ 5·5	0·0	0·25	5·0	6·0	6·25	6·25	Ostnasfjord, 24th „
„ 26	+1·1	+ 5·7	1·7	+11·7							
March 5	+3·4	+ 8·4	3·9	+13·9							
„ 12	0·5	+ 7·6	3·9	+ 8·8	0·5	0·50	3·5	5·25	6·0	..	Husvaagen, 11th March.
„ 19	1·5	+ 2·7	5·0	+11·7							
„ 26	+4·8	+ 9·8	0·6	+12·8	2·0	3·50	4·25	5·25	..	6·0	Folstad, 24th March.
April 2	+0·8	+ 8 0	3·3	+11·7	2·0	2·5	3·25	4·0	6·0	6·0	„ 28th „
„ 9	1·5	+ 7·0	3·3	+10·0	2·0	2·25	3·0	3·75	5·0	5·25	Helle, 6th April.
„ 14	5·5	0·4	11·1	+ 1·1	2·0	3·0	3·25	4·0	5·25	..	Odvar, 8th „
Average .	+2·2	+ 7·2									

A still more interesting table showing how very little the "climate" in the deep water changes even when the temperature of the air above changes 27 degrees (on Celsius' thermometer) at the Lofoten Islands, is the following, also taken from the returns 1881 :—

Day.	Temperature of the Air. Centigrades.	The Temperature of the Water at Lödingen. Centigrades					
		Surface.	10 Fathoms below Surface.	30 Fathoms below Surface.	50 Fathoms below Surface.	70 Fathoms below Surface	100 Fathoms below Surface.
1880							
May 18 . . .	3·3	5·2	4·6	4·2	5·7	6·0	6·4
„ 24 . . .	9·9	6·0	5·2	4·7	5·8	6·0	6·3
June 3 . . .	6·1	5·8	5·4	5·4	4·6	5·2	6·3
„ 10 . . .	11·1	6·5	6·2	5·0	5·7	6·1	6·3
„ 17 . . .	10·3	6·3	6·3	5·0	5·1	6·0	6·3
„ 28 . . .	12·2	8·0	7·3	6·0	5·5	6·0	6·3
July 6 . . .	21·1	9·5	8·8	5·8	6·0	6·3	6·5
„ 16 . . .	9·0	9·0	8·8	6·0	5·2	5·8	6·3
„ 22 . . .	14·4	11·3	10·0	5·8	5·7	6·2	6·5
„ 29 . . .	15·9	10·5	8·3	5·6	5·8	6·2	6·4
August 5 . .	12·5	10·0	8·5	5·4	5·6	6·0	6·4
„ 9 . .	22·1	12·8	11·0	5·6	6·0	6·0	6·4
„ 25 . .	8·7	10·8	11·4	8·8	5·8	6·2	6·4
September 7 .	11·8	10·7	11·0	6·5	6·0	6·2	6·4
„ 14 .	15·9	10·0	10·0	6·8	6·0	6·3	6·4
„ 21 .	15·5	10·8	10·2	6·8	5·8	6·1	6·4
October 7 . .	5·0	8·2	9·2	7·8	6·0	6·0	6·3
„ 25 . .	+2·3	6·8	7·0	8·0	6·7	..	..
„ 29 . .	+5·4	4·9	5·4	8·0	6·8	6·0	6·3
November 16 .	+5·9	3·5	4·3	7·0	6·5	6·2	6·4
„ 25 .	+2·4	3·4	3·8	7·1	6·3	6·2	6·4
„ 30 .	2·1	4·0	4·3	7·1	6·5	..	.
December 13 .	+4·5	3·0	3·1	5·0	6·5	6·1	6·3
„ 23 .	+5·2	2·0	2·0	3·4	6·2	6·2	..
„ 31 .	+2·1	1·5	1·8	5·2	..	..	..
1881							
January 4 . .	+2·3	2·1	2·9	5·8	6·3	6·3	6·3
„ 12 . .	+5·0	2·0	2·5	3·0	4·8	..	..

When the floating eggs of the codfish are carried away by the current to a calm and secure place on the lee-side, they will be hatched under favourable circumstances, and the fry will find an abundance of hiding-places and food along the coast, where seaweed gives shelter and food for a long time. A closer investigation of the "climate" of this part of the Norwegian coast should certainly lead to the conclusion, that a better hatching-place for the eggs and for the development of the fry of the Gadus family scarcely could be found on any coast.

On an average 23 millions of codfish are caught here at Lofoten every winter. The balance of the shoals, and also some millions out of the 23 millions left to spawn, is so enormous, that it would be very hard to express by figures how many eggs are deposited. If only 10 millions of female codfish should have the chance to deposit their eggs, each fish would yield at least 1 million of eggs; and if only 1 per cent. of these were hatched out safely every coming spring, there should be codlings enough to form a new stock for an average take of 25 millions of cod for some thousands of years. The reproduction of the cod is extraordinarily great. While a female salmon has 800 to 1000 eggs for each pound of its weight, a cod has more than 100,000 eggs for each pound; and I do not know of any other fish which has so many eggs in proportion to its weight, with the exception perhaps of the Norwegian winter herring, in which I have counted 70,000 per half-pound, or 140,000 eggs a pound.

It has never been proved that the shoals of codfish at Lofoten have decreased in the last thousand years, and it would be very hard to prove this, facts leading to a somewhat contrary conclusion. That the shoals probably have increased too much, in spite of large takes, may rather be the case, as the codfish sometimes are so meagre and thin, that only want of food in proportion to the enormous shoals can account for it. On an average 400 Lofoten codfish will give one barrel of liver, and two barrels of liver will give one barrel of medicinal cod-liver oil. But in seasons when the cod is of poor quality—for instance, last year—900, and even 1200 codfish are required to yield one barrel of liver; and as this liver itself is also rather poor, four barrels instead of two are required to make one barrel of medicinal cod-liver oil.

STATISTICS OF THE LOFOTEN COD FISHERY.

Number of Fishermen and Boats employed, and of Codfish caught, quantities of Liver and Roe produced, in the Lofoten Cod Fishery every year, 1866–1881, *also the Value of the catch, representing the Amount paid to the Fishermen.*

Year.	Number of Fishermen.	Number of Boats.	Catch and Products.			Amount paid to the Fishermen.	Year.
			Codfish.	Liver.	Roe.		
			Number.	Hecto-litres.	Hecto-litres.	Kroner. 18·2 Kr. =1 Lstlr.	
1866	20,855	5,723	21,000,000	60,320	20,880	5,864,000	1866
1867	21,129	5,906	26,100,000	58,000	19.720	6,168,000	1867
1868	21,088	5.643	24,000,000	48,720	27,840	4.724,000	1868
1869	20,671	5,776	20,400,000	44,080	19,720	4.172,000	1869
1870	18,840	5,030	21,500,000	59,380	23,200	6,480,000	1870
1871	17.420	4,383	17.500.000	49,880	19,140	6,448,000	1871
1872	16,773	4,236	20,000,000	55,680	25,520	7,152,000	1872
1873	17,276	4,275	19,500,000	58,000	20,880	6,220,000	1873
1874	18,821	4,439	20,000,000	46,400	17,400	6,576,000	1874
1875	18,301	4.381	23,000,000	60,320	32,280	6,971,000	1875
1876	21,346	5,790	21,980,000	58.580	23,432	5,682,000	1876
1877	21,287	5.315	28,400,000	78,880	31,320	8,823,000	1877
1878	22,723	5,251	25,270,000	70,180	31,088	6,820,000	1878
1879	25.556	5,609	26,320,000	77,140	31,436	6,435,000	1879
1880	27,232	6,144	27,500,000	81,200	41,992	5,734,000	1880
1881	26,850	6,153	28,400,000	68,092	41,180	5,623,000	1881

Almost at the same time that the Lofoten fishery is carried on, or a little later, cod-fisheries are also carried on at the north-western of Romsdalen every year, and also on the western coast of Bergen, but this is not a large one. These are also fisheries of spawning cod. The fishery on the Söndmöre—a part of Romsdalen—is the largest one, being carried on by eight thousand men, and yielding an average catch of three millions of codfish.

The large cod-fishery of Finmarken, from April to June, is quite a different fishery, it is also a comparatively new trade. Before the commencement of this cod-fishery some spawning codfish are caught; but the main fishery only commences when the caplin has arrived on its spawning grounds, which are on both sides of the North Cape, followed by large shoals of cod preying on the caplin. Therefore caplin is used for bait, and is caught only for that purpose on its spawning-grounds. And as this fishery also is a spawning fishery, its prosecution might be expected to be injurious to future fisheries. Experience has not proved this to be so. Storm and bad weather may interfere, so that the catch will be small, or the shoals of cod on their hunting-trips will not find food enough, and be thin and meagre; but the experience of the last forty years, we are told, is that the caplin will return every year—experience of former times is not recorded—and out of the shoals of codfish following there will be caught some millions of fish, the quantity differing much more than any other of our cod-fisheries; the average catch may be 15 millions for the whole season, ending late in summer, and including different sizes and ages of codfish.

STATISTICS OF THE "CAPLIN-COD" FISHERY OF FINMARKEN.

Number of Fishermen and Boats employed, number of Codfish caught, and quantities of Liver and Roe produced in the Finmarken (Caplin-) Cod Fishery, each year 1866–1881, *and the Total Value of the mentioned articles, representing the Amount paid the Fishermen.*

Year.	Number of Fishermen.	Number of Boats.	Quantities.			Amount paid the Fishermen or Value.	Year.
			Codfish.	Liver.	Roe.		
			Number.	Hecto-litres.	Hecto-litres.	Kroner. 18·2 Kr. = 1 Lstlr.	
1866	?	?	15,600,000	?	?	2,432,000	1866
1867	11,053	2,806	17,309,000	34,640	?	2,712,000	1867
1868	10,858	2,891	14,946,000	32,662	545	1,852,000	1868
1869	?	?	11,371,000	27,306	522	1,688,000	1869
1870	11,741	3,262	14,607,000	44,057	522	3,032,000	1870
1871	16,536	4,528	13,835,000	49,880	290	3,508,000	1871
1872	16,810	4,679	11,854,000	35,960	464	2,356,000	1872
1873	15,321	4,272	16,834,000	49,184	464	3,528,000	1873
1874	17,051	4,519	17,843,000	50,112	406	3,412,000	1874
1875	16,006	4,462	19,725,000	56,260	360	3,326,000	1875
1876	10,730	3,320	5,228,000	14,229	771	964,000	1876
1877	10,537	3,236	17,643,000	56,346	836	3,650,000	1877
1878	16,429	4,644	12,061,000	37,231	715	2,082,000	1878
1879	17,325	4,902	19,333,000	58,194	718	2,666,000	1879
1880	15,447	4,320	23,626,000	65,588	338	2,690,000	1880
1881	11,736	3,417	12,849,000	34,415	162	2,358,000	1881

The quantities of codfish caught in the spawning season at Lofoten and on the coast of Romsdalen and Finmarken, also that caught in the Caplin Cod Fishery, are stated above, and besides these fisheries other, and comparatively smaller cod fisheries, are carried on later in the year on various parts ot the coast, making the whole catch of codfish, and the amount paid to the fisherman for it, to reach the following figures:

The yearly catch of Cod in the "Great Cod Fisheries."

Year.	Number of Cod caught.	Amount paid the Fishermen.
		Kronen. 18·2 Kr. = 1 Lstlr.
1866	44,546,000	11,016,000
1867	51,513,000	11,552,000
1868	47,197,000	8,624,000
1869	41,902,000	8,428,000
1870	49,345,000	13,980,000
1871	40,782,000	13,384,000
1872	47,011,000	14,884,000
1873	49,968,000	15,276,000
1874	47,687,000	14,656,000
1875	57,788,000	15,405,000
1876	40,101,000	10,864,000
1877	66,805,000	19,411,000
1878	50,833,000	12,933,000
1879	63,494,000	13,682,000
1880	68,273,000	12,540,000
1881	55,153,000	10,925,000

THE HERRING FISHERIES.

With regard to the herring fisheries, they can also be traced several hundred years back, the main fishery being, until 13 years ago, the fishing of the winter herring, or the spawning herring, that yielded an average of 800,000 barrels, or 300 millions of fish spawning and spent. The season of this fishery commenced year after year almost on the same day on the same station, and was pretty steady. The "mountain of herring," as the fishermen called it, lifted itself up from the deep basin, and took the old route to the spawning grounds, passing on the road certain stations in a certain week, where the fishermen would wait for it. In the course of years there was some little change in time and place, but not much. The season ended generally in March, the spawning of the herring was the signal: the sea for long distances appeared white from the spawn, and the herring went back to the deep basins. From 1809 until the year 1870 this fishery was carried on, and gave an average of about 800,000 barrels, in 1866–1869 the average was 775,000. But in the year 1870 commenced a remarkable diminution; the year 1871 gave about 100,000, in 1874 20,000 barrels, and in 1875 nothing caught, and since, the takes have been 10,000 to 70,000 barrels.

This fishing of spawning herring has been ruined; the cause is unknown. We see the Scotch and Dutch fisheries of spawning herring are still going on and increasing. Perhaps the yearly disturbance in the spawning time has had some effect on the Norwegian grounds; or perhaps the offal and dead herrings on the bottom of the sea have fouled the grounds, so the adhesive herring eggs could not find sound and healthy places; or, perhaps, the food of the herring has been too scarce to attract the shoals and keep them in the old localities; or something of a kindred nature is the cause of the depletion of the winter herring fishery; or it may be the herring shoals still come to the same regions but some distance farther out from the coast deeper in the water, so nothing of them can be seen. When the old winter herring fishery was fast decreasing, another winter herring fishery sprung up, and was carried on from 1868 till 1874 in quite another part of the coast; and, what is remarkable, this herring was of the largest size, and had scarcely any spawn, and did not come to spawn. Meanwhile there is another fact we notice now every year, and that is, that the catch of the fat herring late in the summer and fall has increased, and increased so much that the total herring fishery now is larger than at any time before; and, what is still more remarkable, this fat herring fishery of about 700,000 barrels a year gives a much better product than the other herring. The Norwegian fat herring is considered to be the very best herring in the world, and fetches higher prices than any other; it is a maiden herring in its best condition of fineness and flavour. We do not know of any other similar large fishery of maiden herring or "matjes."

One herring fishery has been ruined, and we have got another much better in its place. The spawning herring was only to be found in limited localities; the fat herring is to be found all along the western coast. And when our fishermen have commenced to be more familiar with the new fishery and new methods, I think Norway again will be able, as it was before, to export more herrings than any other country in Europe.

STATISTICS OF THE HERRING FISHERIES.

The official reports on the fisheries give the following tables, published by the Cental Office of Statistics of Norway:

Quantities and Values of the catch of Winter-herring and "Large-herring," in the Fisheries of the years 1866–1881.

Year.	Winter-herring.		"Large" or North-herring.	
	Quantities.	Values.	Quantities.	Values.
	Hectolitres.	Kroner. 18·2 Kr. = 1 Lstlr.	Kroner.	Kroner. 18·2 Kr. = 1 Lstr.
1866	1,042,000	6,264,000	74,000	244,000
1867	737,000	5,304,000	69,000	268,000
1868	834,000	6,632,000	446,000	1,452,000
1869	945,000	3,720,000	388,000	908,000
1870	431,000	1,788,000	268,000	1,412,000
1871	129,000	1,200,000	1,058,000	4,992,000
1872	271,000	1,224,000	232,000	1,336,000
1873	111,000	1,020,000	448,000	2,432,000
1874	24,000	288,000	382,000	1,952,000
1875	208	25,000	..	..
1876	11,000	156,000	..	..
1877	36,000	339,000	..	..
1878	37,000	417,000	..	..
1879	89,000	785,000	..	..
1880	61,000	861,000	..	..
1881	85,000	884,000	..	..

The statistics of the fat-herring or summer herring are not so complete as that of the winter herring; but taking the export as a rule, we find the annual catch of summer herring has never been so large as after the winter herring fishery discontinued:

Quantities and Values of Summer Herring and Sprat Fisheries, before and after the Crisis in the Winter Herring Fishery.

Year	Quantities.	Amount paid the Fishermen.
	Hectolitres.	Kroner 18·2 Kr. = £1.
1866	203,000	1,012,000
1867	347,000	2,404,000
1868	249,000	1,248,000
1869	549,000	3,324,000
1870	284,000	1,276,000
1872	481,000	2,508,000
1874	809,000	3,652,000
1876	1,011,000	7,814,000

Number of Fishermen and Boats employed in the Summer-herring Fisheries in the years 1876–1881.

Year.	Number of Boats with Gill-nets.	Number of Bands with Seines or Sweep-nets.	Number of Fishermen.		
			With Gill-nets.	With Seines or Sweep-nets.	Total.
1876	12,463	1,862	25,015	23,816	48,831
1877	7,279	1,660	17,698	24,330	42,028
1878	6,001	1,238	14,214	17,245	31,459
1879	5,316	1,462	12,922	19,554	32,476
1880	6,443	1,258	17,261	17,869	35,130
1881	5.970	1,084	17,134	15,200	32,334

Quantities and Values of the catch of Summer-herring and Sprat in the Fisheries of the years 1876–1881.

Summer-herring.

Year.	Quantities.	Amount paid the Fishermen, or Value of the Catch.
	Hectolitres.	Kroner. 18·2 Kr. = 1 Lstlr.
1876	859,000	7,481,000
1877	826,000	5,881,000
1878	675,000	4,043,000
1879	443,000	3,874,000
1880	720,000	5,726,000
1881	605,000	3,765,000

Sprat.

Year.	Quantities.	Amount paid to the Fishermen.
	Hectoliter.	Kroner. 18·2 Kr. = 1 Lstlr.
1876	152,000	333,000
1877	250,000	570,000
1878	138,000	326,000
1879	130,000	261,060
1880	212,000	516,000
1881	187,000	313,000

Quantities and Values of all Herring and Sprat Fisheries in the years 1866–1881.

Year.	Quantities.	Value, or Amount paid to the Fishermen.
	Hectolitres.	Kroner. 18·2 Kr. = 1 Lstlr.
1866	1,319,000	7,520,000
1867	1,153,000	7,976,000
1868	1,529,000	9,332,000
1869	1,882,000	7,952,000
1870	983,000	4,476,000
1871	1,830,000	9,220,000
1872	984,000	5,068,000
1873	954,000	6,388,006
1874	1,215,000	5,892,000
1875	1,269,000	5,658,000
1876	1,022,000	7,970,000
1877	1,112,000	6,790,000
1878	850,000	4,786,000
1879	662,000	4,920,000
1880	993,000	7,103,000
1881	877,000	4,962,000

THE OTHER FISHERIES.

With regard to our other fisheries, there is not much to note here. The mackerel fishery shows a little change; the fleet with drift-nets goes further out in the ocean, uses more nets, and higher prices are obtained in the English markets than before, when the mackerel was caught in smaller quantities, and was taken by hook and line. In the last few years (1866–1881) the average catch has been 6·4 millions, paying about £40,000 to the fishermen yearly.

Our salmon fishery has decreased. The high prices in the English markets are said to have had the effect of increasing the bag-nets on the Norwegian coast, and in that way disturbed the salmon on its way to the rivers. I do not think we shall be able to develope our salmon fishery until we adopt the British system of protecting the spawning fish, assisted by means of hatching on a larger scale, and by more salmon ladders, and better or more effective laws. You may compare the salmon fishery of the rivers with a poultry yard; you may be able to control every fish passing up or down the rivers, and kill every one if you like. The market price of salmon in Norway is, at present, higher than the market price in London, and instead of sending the salmon in ice to England, we might now better send specialists to England, Scotland, and Ireland to study how a salmon fishery should be developed. If we succeed in this way, I hope we in an early future again shall have the pleasure to send you our salmon at a low price. In 1876 there were taken 412 tons of salmon and trout, and in 1879 338 tons were taken, but in 1881 367 tons, for which there was paid an average amount of £22,000 a year.

Our lobster fishery is still good; we have a close time, and a minimum size for marketable lobster. At an average we catch eleven millions of lobsters, and pay the fishermen a little over £19,000 a year for them. We are, however, on the look-out for a decreasing fishery. We have tried to hatch and cultivate the lobster, but have not succeeded, having not been able to keep the hatched young ones alive more than a few days; then all of them disappear, leaving no trace to tell how or why they disappeared. We are told nobody else has succeeded,[*] nor has anybody been able to give a full and satisfactory explanation of the case. Science must here assist, and, as H.R.H. the Duke of Edinburgh, in his excellent paper, told us, the Norwegian lobster was the very best in flavour, I think science in England may first be called upon to assist here in protecting and developing the favourite lobster for the English table. We should feel very much obliged for such valuable assistance, and should not hesitate to take the advice.

Lastly, I shall make a few remarks about our oyster fishery. Twenty or twenty-five years ago we had plenty of oysters, everyone could get a bucket full for sixpence. At present the price is two guineas for a barrel of oysters, and we have no oysters, or scarcely any. Our oyster banks have been ruined by overfishing and carelessness, and give now altogether not more than three or four hundred pounds sterling a year to the fishermen. We have tried pretty hard to assist nature, but commenced too late and have not succeeded. A couple of warm water basins, in which oysters may grow, almost like flowers in a hot house, have been discovered on our coast; spat from these oyster hot houses may be planted out on natural banks, and grow to marketable oysters, but we have not yet experience enough, and it seems to me that the French and English systems will not answer on our coast without some important alterations.

VALUE AND EXPORT.

Resuming the statistical notes about the beforementioned "great" fisheries on the Norwegian coast, you will find in the following tables how much they all have given

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[*] It may be well to refer for a solution of the difficulty to a paper, "On the Artificial Culture of Lobsters," read at these Conferences, by Mr. W. Saville Kent, F.L.S., F.Z.S.—EDITOR.

THE QUANTITIES OF

Year.	Codfish.		Herring.		Other Sea Fish, Pickled.	Sp Pic
	Salted. (Klipfish).	Dried (Stockfish).	Pickled.	Smoked.		
	Kilog.	Kilog.	Hectol.	Kilog.	Hectol.	H
1866	25,727,300	12,416,800	888,998	..	64,841	
1867	27,569,300	15,484,800	869,181	..	41,448	
1868	28,494,350	14,871,050	906,579	..	52,870	1,
1869	23,701,000	17,715,900	1,277,361	..	48,682	1,
1870	24,834,400	19,035,700	1,081,684	..	66,758	1,
1871	25,135,700	15,847,000	733,017	24,550	70,044	1,
1872	30,982,200	17,514,050	1,445,814	258,950	75,966	2,
1873	27,974,000	18,397,900	892,445	209,050	81,767	2,
1874	29,978,800	19,272,900	1,087,295	355,800	80,532	3
1875	36,826,800	20,865,950	1,037,824	89,850	94,811	2,
1876	33,038,050	19,683,700	1,041,645	248,450	106,056	5,
1877	45,870,050	21,159,650	795,298	27,450	109,679	4
1878	40,961,050	16,025,550	785,321	111,850	71,507	7
1879	44,684,160	20,655,420	730,945	154,197	99,904	7
1880	52,962,300	19,252,490	536,333	115,691	118,348	11,
1881	41,918,720	18,876,200	1,090,623	354,109	167,275	15,

il.	Fish Oil Grounds.	Year.
l.	Hectol.	
55	..	1866
71	51	1867
47	79	1868
30	42	1869
87	..	1870
97	..	1871
24	1,408	1872
25	355	1873
02	912	1874
66	..	1875
33	..	1876
54	883	1877
59	396	1878
65	..	1879
55	1,303	1880
16	1,776	1881

THE VALUE

Year.	Codfish.		Herring.		Other Sea Fish, Pickled.
	Salted. (Klipfish).	Dried (Stockfish).	Pickled.	Smoked.	
	Kroner.	Kroner.	Kroner.	Kroner.	Kroner.
1866	8,232,736	3,123,532	12,685,304	..	232,452
1867	6,837,188	3,532,224	12,809,936	..	283,340
1868	6,838,644	3,284,772	12,422,244	..	274,748
1869	7,773,928	5,593,964	13,903,028	..	363,976
1870	8,614,276	5,267,156	16,405,052	..	508,212
1871	8,391,200	5,840,000	11,368,400	7,400	505,200
1872	9,420,000	5,646,800	17,750,800	51,600	598,400
1873	9,550,800	6,034,000	15,626,800	50,000	786,400
1874	10,757,200	6,114,800	17,631,200	99,600	672,000
1875	11,958,400	6,540,800	17,176,800	25,200	935,200
1876	13,849,200	7,048,100	19,193,600	79,500	1,061,500
1877	14,365,000	7,275,100	13,503,500	8,800	1,000,000
1878	14,541,300	4,918,800	10,047,900	35,800	597,100
1879	12,282,100	5,533,700	12,282,100	49,300	809,300
1880	12,304,500	5,274,200	9,504,200	37,000	805,900
1881	16,012,000	6,134,800	16,280,300	113,300	1,574,200

Total Values.	Year.
Kroner.	
2,639,576	1866
1,957,552	1867
9,454,004	1868
5,297,084	1869
0,088,080	1870
4,929,800	1871
3,502,484	1872
2,948,800	1873
4,968,800	1874
6,901,600	1875
1,729,100	1876
7,273,800	1877
0,682,500	1878
0,859,500	1879
9,076,300	1880
0,866,100	1881

[*To face p.* 291.

each year (1866-1881) to the fishermen as payment for the catch:

THE GREAT FISHERIES IN 1866-1881.

Year.	Codfish.	Herring and Sprat.	Mackerel.	The Summer Fisheries of Coal-fish, Ling, etc.	Salmon and Trout.	Lobster.	Total.
	Kroner.	Kroner.	Kroner.	Kroner.	Kroner.	Kroner.	Kroner.
1866	11,016,000	7,520,000	628,000	960,000	252,000	280,000	20,656,000
1867	11,552,000	7,976,000	792,000	980,000	236,000	256,000	21,792,000
1868	8,624,000	9,332,000	580,000	1,100,000	180,000	264,000	20,080,000
1869	8,428,000	7,952,000	600,000	1,168,000	256,000	240,000	18,644,000
1870	13,980,000	4,476,000	684,000	1,204,000	232,000	240,000	20,816,000
1871	13,384,000	9,220,000	900,000	1,360,000	220,000	220,000	25,304,000
1872	14,884,000	5,068,000	716,000	1,396,000	240,000	252,000	22,556,000
1873	15,276,000	6,388,000	832,000	1,748,000	408,000	252,000	24,904,000
1874	14,656,000	5,892,000	796,000	1,328,000	352,000	296,000	23,320,000
1875	15,405,600	5,658,000	719,000	1,270,000	407,000	337,000	23,796,000
1876	10,864,000	7,970,000	621,000	2,000,000	458,000	355,000	22,268,000
1877	19,411,000	6,790,000	703,000	1,790,000	449,000	291,000	29,434,000
1878	12,933,000	4,786,000	671,000	1,977,000	362,000	315,000	21,044,000
1879	13,682,000	4,920,000	681,000	1,371,000	336,000	342,000	21,332,000
1880	12,540,000	7,103,000	696,000	1,448,000	382,000	405,000	22,574,000
1881	10,925,000	4,962,000	769,000	2,175,000	401,000	377,000	19,609,000

As almost the whole catch put in the market for export is cured in some way or other, the statistics of the export, as shown on attached Table, contain the fish or fish products under the names of the goods prepared, with the exception of a few articles exported as fresh fish.

It is a singularity of the export or consumption of cured fish that it has always the special and main market in one or two countries, while the balance of the fish-consuming countries does not at all care for it. To show the character of the Norwegian export in this respect, I will give the "special" export of some important articles, compared with the whole export of the same, in the year 1881.

Norway's Export.		The main Market and its Import from Norway.	
Exported Goods.	The whole quantity.		
Codfish (klipfisk)	41,918,720 kilog.	30,361,910 kilog.	to Spain.
Dried cod (stokfisk)	18,876,200 „	7,879,780 „	„ Italy and Austria.
Herrings, pickled	1,090,623 hectl.	372,259 hectl.	„ Germany.
Sprats „	15,574 „	12,292 „	„ Sweden.
Mackerel, &c., fresh	1,976,100 kilog.	1,860,900 kilog.	„ Great Britain.
Salmon, fresh .	379,670 „	280,780 „	„ „ „
Other salt-water fish pickled	167,275 „	166,937 „	„ Russia and Finland.
Lobsters alive .	1,001,981 pieces	515,177 pieces	„ Great Britain.
Fish oil . . .	124,916 hectl.	52,765 hectl.	„ Germany.
Cod roe . . .	52,750 „	46,631 „	„ France.
Fish guano . .	8,344,550 kilog.	4,738,810 kilog.	„ Germany.

After this you will understand that with regard to cod and herring we have an abundance of fish close to our coast at certain times of the year, and we are able to supply the world with large quantities, and do really do it, as has been seen from the tables above; but as we catch the fish either in the dark winter time, or at long distances from the European markets, and in very large quantities at a time—taking cod by the millions and herring by the hundred millions in a few weeks—we are not able at present to export the fish fresh. We are compelled to dry or cure almost all our cod and herring. It would not pay our fishermen to fish much in summer, or for the fresh fish markets. But I hope improvements will come. This exhibition may give us some important advice in respect of fishing more and fishing cheaper, but what we are more interested in are two things. In the first place we wish to know how to bring the fish fresh or in ice to your markets for a low price all the year round. Not every kind of fish will stand a long transport on ice, or in frozen condition; it would be a great benefit to the fishermen as well as to the fishmongers to know how to manage this without injuring the fish neither when on ice nor by thawing it. In the second place we want to know how the reception of such fish should be arranged in a more convenient way. We do not think that the Norwegian fish should expect to be especially welcomed at the gates of your fish markets—Billingsgate and other gates—we only wish to know if some arrangements could not be made to keep the fish fresh for some time, to diminish the great risk that exporting fresh fish to the English markets now runs. We feel sure that, for instance, by arranging refrigerator-warehouses, the effect would be that the markets would not be overstocked and lots of fish spoiled whenever a few extra fish-carriers arrived. Prices would rule more steady, the risk of exporting fish to England would be very trifling, and the supply get very large and very cheap. As it is now, fish will never be a cheap food for the poor in large cities, never; the large amount of spoiled fish must be paid by those who buy the good fish. On the English side of the North Sea arrangements must be made to get the benefit of the abundance of cheap and good fish on the Norwegian coast. One thing could easily be done at once. You could introduce that kind of cured Norwegian fish we now ship to South Europe, South America, and even to China. If the English cooks knew how to make a delicious dish out of a Norwegian stock-fish, you would be able to have a fish dinner for a whole family of five persons for less than a penny a piece paid for the fish. Norway exports at present dried, salted, and pickled fish amounting to a quantity that represents 600,000 tons of fish alive. Almost all this fish is made into food for the poor classes in various countries of the world, and it is a pity that such cheap food does not suit the English taste or the English stomach. The Italian and Spanish way of cooking cured codfish is considered to be a very good one, and to give the English cooks a chance to try the same, I shall in an appendix to this paper (page 299) present to you some recipes worth a trial.

THE CHEAPNESS OF NORWEGIAN FISH.

There is no doubt that the Norwegian fisheries, now yielding about 600,000 tons of fish average a year, would be able to give one million tons if the people abroad were prepared to receive and the Norwegian fishermen in consequence prepared to catch fish at other times of the year than in winter and the spawning season. England would for us be the first, best, and nearest market we should try, and it may already now be of some interest for you to know the average prices on the Norwegian coast at present for some kinds of fish you could have in the London market in less time than forty-eight hours after the fish was caught:

10 to 12 pound codfish would cost	4*d.* to 6*d.*	each.
10 to 12 pound coalfish	3*d.* „ 5*d.*	„
50 pound halibut	10*s.*	„
Cusk, large ones	6*d.*	„
Haddock, middlings	2*d.*	„
Pollack „	2½*d.*	„
Skate	1*s.*	„
Red mullet or Rosefish	2*d.*	„
Ling, large ones	2*s.*	„
Herrings (very often)	2*s.* or 3*s.* for 200 lbs.	

The prices quoted above are for fresh fish per head, taken from the fishermen's boat or delivered there. They are, as you see, low indeed, much lower than the poorer classes in Spain and Portugal, in Italy and Austria, in Germany and Sweden, in Russia and Belgium, pay for the cured Norwegian fish when delivered in the Norwegian harbours for export. There is good reason to say that those prices low as they are would leave the English fishmongers a good profit after shipping expenses, freight, and refrigerator-warehouse expenses are paid, even if the fish were sold in the English markets at a considerably lower price. Nay, the general public in England would in this way get a chance to have good fresh fish from Norway at a lower price than the poor classes in other countries now pay for the same kind of fish salted, dried, or pickled. The English public would get the fish in a more nutritious form and cheaper.

To what amount expenses are swelled up by curing and packing the fish, you may judge from the following table shewing the amount paid to the fishermen, and the amount representing the value of the exported, cured fish products for the same year :

Year.	Amount paid the Fishermen 18·2 Kr. = £1 sterling.	Amount representing the Value of the Export 18·2 Kr. = £1 sterling.
	Kroner.	Kroner.
1872	22,556,000	43,502,500
1873	24,904,000	42,948,800
1874	23,320,000	44,968,800
1875	23,796,000	46,901,600
1876	22,268,000	51,729,100
1877	29,434,000	47,273,800
1878	21,044,000	40,682,500
1879	21,332,000	40,859,500
1880	22,574,000	39,076,300
1881	19,609,000	50,866,100
Average .	23,083,700	44,880,900

As the fish is not exported the same year it is caught and cured, and as the export of fish products to a small extent includes some branches that are not accounted for in the amount paid the fishermen, the expenses of curing and packing the fish and fish products are not shown quite adequately by the difference between the two amounts.

At present Norway does not furnish the English public with fish to any large extent, but I am happy to say that what you get is some of the very best kind of fish in the very best form. You get our salmon, mackerel, and lobster fresh or alive. Our whole export of fish to the English consumers is surprisingly small, and I cannot account for this in any way but this, that the fish trade has not yet arrived to what it ought to be, and that the English fishmongers have not sufficient knowledge of the great supply of cheap fish that could be had from Norway. For the public interested in the matter it must be of great importance to know how large an amount of fish and fish products Norway exports, and how limited the amount exported to Great Britain and Ireland really is. The following statistical tables will show it, giving the weight of and value of all different fish products, exported in 1881, as well as all to Great Britain and Ireland alone.

Goods Exported in 1881.

	The whole Export.		To Great Britain and Ireland.
	Weight Net in Kilogrammes. 100. kilogs. = 1 Ton.	Value in Kroner. 18·2 K. = £1 sterling.	Value in Kroner. 18·2 K. = £1 sterling.
Salmon, fresh and iced . . .	379,670	569,500	421,200
Mackerel, „ „ . . .	1,829,210	365,800	386,300
Other kinds of fish, fresh and iced	146,890	52,900	
Stockfish—			
Dried and split fish	1,770,810	717,300	175,600
Coalfish	3,377,520	675,500	
Dried and round fish . . .	13,597,960	4,707,900	
Other kinds of stokfish . . .	129,910	34,100	
Dry salted codfish, &c. (klipfisk) .	41,918,720	16,012,000	1,980,900
Salted herrings—			
Spring or winter herring . .	4,956,524	835,700	32,900
"Large" herring	360,254	75,400	763,400
New or mixed herring . . .	139,750	16,300	
Fat or summer herring . . .	71,591,388	13,485,800	
Sprat	6,728,554	469,400	
Iceland herring	9,740,790	1,359,200	
Other kinds of herring . . .	276,318	38,500	
Salted fish, not referred to above—			
In barrels and kegs	1,410,830	184,100	1,500
In vessels	14,032,660	1,390,100	
Anchovies	1,308,216	734,500	
Smoked salmon	2,980	6,000	
Smoked herring.	354,109	113,300	
Lobster	500,990	400,800	206,100
Oysters	6,800	6,800	
Shell fish	40,000	1,600	
Fish meal	1,108	400	
Skin of polar bears	176	600	
„ seals	229,031	301,200	243,900
„ walrus	37,300	11,200	10,100
„ dolphins	18,840	22,600	
Tusk of walrus	665	2,100	
Whalebones	17,120	154,100	145,600
Roe of codfish	6,330,000	1,091,900	
Sounds of fish	21,918	28,500	
Fish guano	8,344,550	1,335,100	422,700
Fat of seals and whales . . .	602,172	252,100	
Spermaceti oil	43,560	24,200	1,411,300
Medicinal cod liver oil—			
Steam refined	882,291	681,700	
Natural	1,164,267	704,200	
Bright cod liver oil	1,839,354	905,100	
Pale brown ditto	2,898,717	1,208,400	
Brown ditto	4,004,952	1,582,400	
Other kinds of fish oil	827,607	356,500	
Footing of fish oil	165,168	12,400	

As you will understand, Norway has, so far as fish supply is concerned, great resources, its coast being a favourite place for the spawning codfish and herring, the fjords and sheltered bays a pleasant nursery for an abundance of fry, and the fishing grounds a large extended meeting place for fish in shoals of inconceivable dimensions. The Norwegian sea, with its deep basins and steady moderate temperature, must be very attractive for the finny tribe, and whether it is to science or practical trade, the learned ichthyologist or the hardy fisherman, who wishes to study the harvest of the sea, in the waters on the other side of the "100 fathom line," and all the conditions on which it depends, or to which it is connected with innumerable ties, the Norwegian coast and sea have afforded resources of the greatest importance. For hundreds of years that part of the North Atlantic seems to have been inexhaustible with regard to the fish supply for a greater part of Europe. Time and trade have changed much since the first century of this traffic, and other countries than Norway may now be said to have taken the lead in the modern fish trade as well as in the fish culture and the science attached to both; but I feel confident that in most of the questions which this Great International Fisheries Exhibition will bring forth, the Norwegian sea, its finny tribe, its vegetation and animal life, will still hold a prominent and important place to all interested in the fisheries or any of their appliances.

APPENDIX.

A.—HOW TO COOK STOCKFISH.

(FRANCO-ITALIAN RECIPES COLLECTED IN ITALY BY MISS H. S.)

The Norwegian Stockfish is a dried fish cured without salt.

Before cooking the fish must be prepared in this way :—Beat it with a wooden club until quite soft and all bones are loose; take out all bones. Soak it for 20 hours, then wash, clean, and dry it carefully.

The Italians prefer meagre fish to plump, and always serve the stockfish with the skin; they also prefer oil, or oil and butter mixed, to butter. The fish is always put on the fire in cold water and taken off before boiling, as boiling makes the stockfish tough. Steaming is still better and makes the fish whiter and softer.

1. *Plain Stewed Stockfish.*

The fish, after being well washed, cleaned, and boned, is put in a pan with butter (and oil mixed) and a little water. Simmer for 45 min. to 1 hour over a slow fire; stir frequently.

2. *Stewed Stockfish.*

Having put the cleaned and boned fish on the fire until about boiling, place butter (and oil) and onions in a stewpan, and when it commences to brown, put in the fish, and cover the pan and the lid with paper. Stew slowly.

3. *Stockfish with Potatoes.*

Put butter (and oil) in a stewpan, make a layer of half-done fish alternate with a layer of slices of potatoes. Simmer very slowly.

4. *Stockfish with Mustard.*

Brown light thin slices of onion in butter and oil; put in small pieces of fish with spices and mustard. When the fish commences to brown pour on water, not to cover, and add, if required, until done.

5. *Stockfish with Tomato Sauce.*

Brown chopped parsley and onion in butter and oil (or in oil), put in fresh tomato sauce, and let all cook until about boiling, then put in the fish, whole or in pieces. Stir until done.

6. *Stockfish à la Villageoise.*

Chop a handful of parsley, 6 small onions, 1 eschalot, 2 stalks of celery, and a little lemon peel; brown all in 2 min. with a little butter (or oil) in stewpan. Put in a medium-sized, boned, and cooked stockfish, with salt, pepper, and spices. Cook all for a few minutes, and thin it with 2 glasses of white wine. Simmer 15 min. When ready to serve add the juice of one lemon.

7. *Stockfish au gratin.*

Let the fish come to the boiling point, then take out the bones and cut in pieces. Put in a deep dish 3 oz. of butter, on which place a layer of fish, sprinkle over 2 tablespoonfuls of grated Parmesan cheese, a pinch of salt, add another layer of fish, cheese, etc., until the dish is full. Pour over all ½ glass of white wine, cover with a beaten egg, to which add 2 oz. of butter, cover with grated bread crumbs. Bake all in 35 min. in a slow oven.

8. *Stockfish à la Pauvre Femme.*

Brown in a stewpan, with a little butter and oil (or oil), 4 kernels of eschalot until light brown, then add a teaspoonful of flour, and mix all lightly, and add after a while 2 glasses of white wine and 2 glasses of water or broth, a little salt, 2 grains of pepper, and 6 fresh scalded tomatoes (from which skin and seeds are taken out) cut in large square pieces. Put in a middle-sized, half-boiled, and boned stockfish, together with 6 potatoes cut in large square pieces. Cover the stewpan and let it boil for 45 min., season with salt, and serve it very hot.

B.—HOW TO COOK SALTED CODFISH (KLIPFISK).

Good salted codfish should be white and not very thick, and flake nicely when soaked.

Soak it in plenty of water for 30 hours.

1. *Morue à la Lombardie.*

Scald the fish in boiling water, and take out all bones and the skin, cut it in pieces, and put it on the fire in cold water. Having boiled for

2 min., strain off the water and dry the fish, and dredge with flour. Having melted a lump of butter together with slices of an onion and a little chopped parsley until light brown, put the fish in, pour on a little white wine, stir up when boiling slowly. Serve it very hot.

2. *Morue frite.*

Boil the fish, cut it in middle-sized pieces, dip them in Bechamel sauce and let them cool. Having cut the fish in smaller pieces, sprinkle them with bread crumbs, put on beaten eggs, again sprinkle with bread crumbs, and fry. Serve with sauce of fried parsley.

3. *Morue à la Marseillaise.*

Cut two well-soaked, small codfish in four pieces, and put on fire in cold water. When boiling strain off the water, and take out all bones, and skin. Having heated ½ wineglass of olive oil, 2 chopped onions, and a little lemon peel, one minute in a stewpan over the fire, put the still warm fish in and set the pan on hot ashes, mash the fish while adding milk and a little oil until all is well mashed and half firm (as soft butter). Season with salt and spices to taste, add the juice of 2 lemons, a pinch of chopped parsley, a few light-fried truffles or mushrooms. After being well stirred a while, put all in a dish garnished with bread-crust browned in butter, and serve it.

NOTES
ON THE
FOOD FISHES AND EDIBLE MOLLUSCA
OF
NEW SOUTH WALES, ETC.

BY

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INTERNATIONAL FISHERIES EXHIBITION OF 1883.

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NOTES
ON THE
FOOD FISHES AND EDIBLE MOLLUSCA
OF
NEW SOUTH WALES.

THE greater portion of the exhibits in the New South Wales Court have been liberally supplied by the Trustees of the Australian Museum, at the request of the Commissioners of the New South Wales Fisheries, having been specially prepared by the skilled taxidermists of that institution, the Commissioners themselves undertaking, through their energetic Secretary, Mr. Lindsay Thomson, the preserving of the tinned fish and oysters, and procuring from the various beds the large and interesting collection of oysters displayed in the Court, as well as the fishing-boat, nets, and lines, the fish-oils, the photographs, and oil paintings of the food-fishes, with many other interesting articles mentioned in the Catalogue.

The notes appended to each of the different samples of oysters have been collated from the reports sent with each to the Commissioners by the inspectors and sub-inspectors of the various leased beds in the colony of New South Wales.

One of the most marked features in the fish-fauna of the Australian Seas is the almost entire absence of the cod tribe (*Gadidæ*), a family among which the codfish itself, the ling, the haddock, the English whiting, the hake, &c., supply such immense quantities of valuable food, and afford so much employment to thousands of human beings in the Old and New Worlds. This want is, however, amply supplied by members of others families, such as the Mugillidæ, Sciænidæ, and Carangidæ, which visit the Australian shores in vast shoals. From among these, fisheries might be formed, which, if carried on under efficient management, experience, and skill, with a comparatively small expenditure would, in the future, bid fair to rival the largest and most important in the world. Unfortunately there are at present no fish-curing or canning establishments in New South Wales.

With the exception of one species, ***Retropinna richardsonii***, Gill, a species not used for food, the Salmonidæ are naturally absent, but this family has been so successfully introduced into the Tasmanian waters, that it is highly probable, ere long, even salmon will form an important article of export.

With regard to the Clupeidæ (the herrings, pilchards, sprats, and anchovies), the species of this family are very numerous, and occur in quite as large shoals as in any other part of the world.

When the Mugilidæ, the most valuable for canning purposes, but which only occur at a certain season of the year, are gone, there are many other families the members of which are also found in immense quantities, for instance, the Sciænidæ: ***Sciæna antarctica***, and ***Otolithus atelodus;*** the Sparidæ: ***Chrysophrys australis***, ***C. sarba***, ***Girella tricuspidata***, ***G. simplex***, and ***Pagrus unicolor;*** the Carangidæ:

Seriola lalandii, S. gigas, S. grandis, Temnodon saltator; the Scombresocidæ: *Hemirhamphus intermedius* and *H. regularis;* the Scombridæ, which include the mackerels: *Scomber australasicus, S. colias, Thynnus pelamys;* the Trachinidæ: *Sillago ciliata, S. maculata, S. bassensis*—all of which occur at various seasons of the year, and, being obtainable in large quantities, would afford lucrative employment to hundreds of men, women, and children, and food for thousands.

Moreover, with more experience and knowledge of the proper trawling-grounds, still further sources of supply will arise.

At present, a great difficulty is the proper preservation of fish after their capture for transit inland and elsewhere. This arises from the heat of the climate, the scarcity of ice, and the want of efficiently constructed and swift boats for transit. Doubtless such wants will in due course be remedied, as the demand for fish-food is daily on the increase.

The fishing industry as yet may be regarded as in its infancy. This is shown by the fact that the only nets in general use by the fishermen are the ordinary drawing-seines and mashing-nets, while there is only one style of fishing boat, a model of which is exhibited in the Court.

It may not be out of place here to draw attention to some of the principal features of the New South Wales Court, among which may be enumerated the large sun-fish, *Orthagoriscus*, sp., the Luth, *Dermatochelys coriaceus*, the group of Péron's Seals, *Ctaria cinerea*, exhibited for the first time in England and Europe, the large collection of food-fishes, stuffed and in spirits. The sponges and oysters deserve attention, while the walls are decorated by life-sized oil-paintings of fishes and large photographs of the fish-markets and certain of the Government offices and other magnificent buildings, highly creditable to Mr. James Barnet, the colonial architect.

As preliminary to the list of objects exhibited, notes of the chief families of Australian food-fishes, &c., have been introduced, as follows:—

BERYCIDÆ.

This family affords us with but one useful food-fish, *Beryx affinis*, known among the fishermen of Port Jackson as the "Nannagai," or, as it is sometimes spelt, "Nannygy." It is a most delicious fish, always brings a high price, but is seldom found in sufficient numbers to form a regular supply. It is a deep-water fish, but enters the harbours during the summer months to spawn in small troops, and is then found on the sandy flats near reefs in comparatively shallow water, where it is usually taken with the hook and line. It is more plentiful along the coast, frequenting the Schnapper grounds, and is there taken in larger numbers. Future search will probably be rewarded by finding its winter-quarters, or localities where it is more plentiful, from which a regular supply can be obtained.

It is a beautiful fish, of a bright deep red colour. Very young specimens are sometimes taken in the dredge and trawl, ample proof of its breeding in Port Jackson. Recently, Mr. Johnstone, of Hobart, has reported it from Tasmania—a curious fact, as formerly this genus was supposed to be confined to warmer waters and not to extend beyond the semitropical zone.

PERCIDÆ.

Among the Percidæ, a family largely represented in ustralia there are but few species which occur in large shoals. The "Salmon" of our fishermen, *Arripis sàlar* (*A. truttaceus*, C. et V.), is one of the most important. It occurs at all seasons on our coast; and during the summer months it enters the harbours, bays, and estuaries in immense shoals, probably to spawn, some going up the rivers into the brackish water. They attain a great size; and, when in pursuit of their prey, take prodigious leaps out of the water; they afford good sport to the amateur fisherman, but the supply for market is usually taken with the seine. It is a beautifully marked fish, especially when young, and in weight up to 2 or 3 lbs.; it is known as the salmon trout; but being one of the most common fish in the southern market, it is not so highly appreciated as it deserves. If properly treated, after the manner of the cod and ling, it would form just as palatable an article of food; and, from its large size and the prodigious numbers in which it congregates, it is capable of affording a large quantity of valuable food either for home consumption or export.

Enoplosus armatus, a beautiful and grotesquely marked fish, with large and curiously developed fins, is another species worthy of mention. Although a delicious fish, from its small size it is not much sought after. It is usually plentiful in the harbours at all seasons of the year, frequenting the rocky shores and small open patches among the weeds in troops of from ten to fifty in number. It is occasionally taken in the seine or in "set" nets with other rock-fish (*Labridæ*, &c.).

The trumpeter perch (*Therapon cuvieri*), was formerly very numerous in Port Jackson, and occasionally taken in immense quantities. It is a small, delicious fish, and prettily striped along the body. It seldom exceeds eight inches in length, and takes the bait readily. When caught it emits a "tooting" note, not unlike that emitted when dying by some of the Siluridæ (*Arius australis*); hence its local name of "trumpeter." Like ***Enoplosus armatus***, it is not a migratory fish, and may be found in the harbour of Port Jackson all the year round in small quantities.

Another valuable food-fish belonging to this family is *Serranus damelii*, the Black Rock-Cod. This fish was formerly plentiful, but now not so abundant in Port Jackson; to the northward, however, of our harbour it is still found in considerable numbers, and attains to a large size, sometimes weighing more than 20 lbs. The following is an extract from the report of the Royal Commission on the Fisheries of New South Wales, 1880, p. 10:—

"The genus *Serranus* comprises most of the fishes known as 'Rock Cod.' There are many species of it in these seas, and the number increases in the warmer latitudes of the north, but one only is sufficiently useful as an article of food to merit notice, and that is the 'Black Rock-Cod' (*Serranus damelii*, Günther)." "It is found on all the rocky parts of the coast, and in the harbours about bold headlands. It takes the bait readily, and is seldom captured by the net. It attains a great size, fishes weighing 35 and even 40 lbs. being not uncommon. It is found as far as Jarvis Bay to the south; to the north it has probably a much more extended range. It has been observed of this fish that those caught off the 'Solitaires' and other places to the north of Port Jackson are, as a rule, of larger size than those found to the south. It is rarely seen now in the Sydney market, owing to the great falling-off in the supply obtained from Port Jackson Heads, Coogee, and other places where it was formerly abundant. It is difficult to account for this falling-off in the supply; for the causes which undoubtedly affect the supply of other fishes do not apply to this. The spawn is not deposited in shallow bays constantly raked by nets, the young are never taken in the seine, and the number of the adult fish captured has never been sufficient to account for the deficiency. It is probable that the fish has merely sought retreats further removed from the stir and traffic of Port Jackson."

Although the fact of an abundance of this valuable food-fish being found further north on our coasts must be well known to most of our fishermen, it is curious that it is so scarce in our markets. But this is probably due to the absence of fast steam-carriers; and this drawback is likely to continue until we have two or three fast steamers, fitted-up with ice-compartments, to ply round our shores and pick up and bring to market the various takes from the fishing-boats.

Another good table-fish is the "bull's-eye," a beautiful salmon-red fish with small scales, known as *Priacanthus macracanthus* (C. et V.). At times it enters the harbours in considerable numbers; but the supply is irregular.

Another of the Percidæ, *Plectropoma ocellatum*, the Wirrah of the fishermen, is more plentiful. It is when first caught a handsome fish, of a pale olive-brown or olive-green colour, with numerous bright blue dots on spots of a lighter tint. It is not considered a good table-fish, probably because few know how to cook it.

A more important fish, but one which we know very little about, is a fine perch-shaped *Glaucosoma*, which has been named *Glaucosoma scapulare*, on account of the peculiar development of the suprascapular bone, which protrudes through the skin to the length of more than an inch. This fish was formerly not scarce on our coasts, but is now seldom obtained, perhaps from its frequenting very deep water. Occasionally specimens are obtained in Schnapper fishing; they attain a large size, reaching to 8 lb. weight, and are known as the sea-bream.

The perch (*Lates colonorum*), the "Murray cod," and other members of the Percidæ form important articles of food, some of which will be considered under our freshwater fishes.

GERRIDÆ.

Gerres ovatus, a small but delicious fish, known to the fishermen as "silver bream," "silver bellies," &c., is often taken in great numbers at certain seasons; it seldom reaches 8 inches in length, and appears to enter the harbour of Port Jackson in July. It is a handsome fish, of a bright silvery hue, with a silver-blue tint on the upper portion of the body. The flesh is rather soft, probably from the species being one that does not keep well; nevertheless it is of good flavour.

MULLIDÆ.

This family supplies us with two or three species of very delicious fishes, known as red mullets. They are usually taken at night in the seine and trawl, but seldom in sufficient numbers to warrant them being classed among our useful fishes. The largest species is *Eupeneus porosus*, a very beautiful fish, of an orange- or vermilion-red, with yellow streaks and blue and violet markings and spots. It reaches to 12 inches in length.

SPARIDÆ.

This family furnishes some of the most important of our food-fishes, and from it comes our chief supply. The carnivorous Sparidæ include the Schnapper, *Pagrus unicolor*, the immature young of which are known respectively as the "squire" and red bream. It is a hghly-coloured species, of a rich pink or red colour, with blue iridescent on the scales.

The following extract is taken from the Report of the Royal Commission (pp. 12-13) before mentioned:—

"The Schnapper (*Pagrus unicolor*) is the most valuable of Australian fishes, not for its excellence, for we have many more delicious,* but for the abundant and regular supply which it affords of a very nutritious and wholesome description of food. It is found on all parts of the Australian coast, but most abundantly on that of New South Wales. It is a deep-water fish, found generally on or near rocky points, or reefs running out for miles from the coast. Its food is chiefly the mollusca living on the rocks, though the readiness with which it will snap up bait of the most varied descriptions indicates tastes of rather an omnivorous character. Like all or most fishes, it has its periods of migration and accumulation in shoals, a movement so well expressed by the term 'schooling' that we shall adopt the phrase for the future. The time of the appearance of the 'School Schnapper' is the early part of summer; it is then believed to be at least three years old; the previous stages of its existence being well known under the names of 'Red Bream' at the age of one year, and of 'Squire' at two. At a still greater age the Schnapper seems to cease to school, and becomes what is known as the 'Native' and 'Rock Native,' a solitary and sometimes enormously large fish." "At the first appearance of the school-fish in early summer the roes are small; but the full size is attained in or about January, about which time no doubt the spawn is deposited. The actual mode of the deposition or attachment of the spawn has never been observed, and the same may be said of the date of the first appearance of the young fry, but there can be little doubt that the deposition takes place in moderately deep water near the land, and that the young are probably hatched before the winter season. The young fish, in the shape of 'Red Bream,' are abundant in the harbours and inlets, but are seldom captured in large quantities in the seine; they take the hook, however, freely, and the capture of them is a very favourite pastime of the

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* [This is a matter of opinion; many assert that there is no better fish in the Australian waters than a half-grown Schnapper.—E. P. R.]

Sydney people. The Schnapper is generally caught by the hook, but instances have been known of their capture in Lake Macquarie and other places by means of very deep nets."

The black bream (*Chrysophrys australis*) and the tarwhine (*Ch. hasta*) are both valuable food-fish, which form a regular supply; they attain a weight of 4 to 5 lbs., and always meet with a ready sale, although the tarwhine is said not to keep so well as the black bream.

Among the herbivorous Sparidæ the blackfish, under which name several species of *Girella* are known, give us a regular and palatable supply of good food. These are taken in large quantities with the seine, and sometimes by amateurs with a line and hook baited with green seaweed.

Girella tricuspidata, *G. simplex*, and *G. ramsayi* are the species chiefly found in the market, and most esteemed. *Haplodactylus lophodon* and *H. obscurus*, belonging to the same section, do not furnish a regular supply; the latter, known to our southern fishermen as the "butterfish," is highly esteemed.

SQUAMIPINNES.

The "sweep," *Scorpus æquipinnis*, is the only fish of this family that is used with us as an article of food, or found in sufficient numbers to be of any market value. "It is not much thought of, yet at times it is brought to market in considerable quantities, and finds consumers at fair prices. The schooling-season is midsummer, and the spawn is probably deposited in the harbour, as the young sweeps are frequently caught in the seine."

It is occasionally taken in line-fishing, and, although not so good as the black bream and others, is by no means a bad table fish.

CIRRHITIDÆ.

One of the most important families, supplying a large amount of valuable and delicious food. Among the best are the trumpeters (*Latris*), of which there are several species, chiefly frequenting our southern coasts. The hobart trumpeter (*L. hecateia*) is one obtained in large quantities, and in a smoked and dried state forms an article of export from Tasmania to the other colonies. *Latris hecateia* is not often found on the New South Wales coast, but *L. forsteri* occasionally finds its way into the market, and is considered a delicacy. The Morwongs—*Chilodactylus macropterus*, *C. morwong* (sp. nov.), and *C. fuscus*—are more plentiful, and find a ready sale. *C. vittatus* is occasionally taken in the seine, but is considered rare; it seldom attains a foot in length, and, like *C. fuscus*, is a handsomely marked fish. Some interesting and valuable information on these fishes will be found in the Report of the Royal Commission on Tasmanian Fishes, 1883.

TRIGLIDÆ AND COTTINA.

"The Australian species which can be classed as edible are the 'Red Rock-Cod,' four species; the 'Flatheads,' four species; and the 'Flying Gurnets,' three species. The 'Red Rock-Cod'—*Sebastes percoides* and *Scorpœna cardinalis*, *cruenta*, and *bynoensis*—are rock- and ground-fish, and readily take the hook." "The 'Flatheads' of the coast are *Platycephalus fuscus*, *levigatus*, *bassensis*, and *cirronasus*: of these the first, *P. fuscus*, is the Flathead best known and most common in Port Jackson. All the species are of excellent quality, and may be ranked among the best of our fishes. Like the Red Rock-Cod, the Flathead is a ground-fish, but is found on a sandy bottom only, and generally at only a moderate depth. It is taken both by the hook and net. But little information is obtainable about the history of the Flathead;

but it seems to come into this harbour full of spawn in midsummer, and probably deposits its ova on the sandy banks in tolerably deep water. It is probable that the trawl-net will be found of most service in reaching the haunts of this very useful fish, which only requires to be better known to be better appreciated.* The 'Flying Gurnets'—*Trigla kuma* and *polyommata*, and *Lepidotrigla papilio*—are very beautiful and excellent fishes, but very rare and uncertain in their movements. All we know of them is that they are deep-sea fishes, appearing, when they do appear, only in summer." Two species at least breed in Port Jackson, the young being frequently seen in shallow water.—R. R. Com., pp. 16, 17.

TRACHINIDÆ.

The Whitings, *Sillago*, are perhaps the most highly prized of all the Australian food-fishes. Four or five species frequent our coasts; but the principal, and the species most common in our markets, are the "sand-whiting," *Sillago maculata*, and the trumpeter whiting, *Sillago ciliata*. The latter is perhaps the more common, and grows to a larger size than the former. They are taken in considerable numbers during the summer months, and all through the year; but after having deposited their spawn are not considered in season until they have recovered from this arduous duty. Although occasionally met with in the deep waters of the bays, and sometimes taken with the line, the supply comes from the sandy shallow flats which they usually frequent, being secured with the seine, and with the trawl the writer has also secured many fine fish. A curious habit of both species (*Sillago maculata* and *S. ciliata*) is perhaps worth mentioning—when, finding themselves enclosed by the seine, they burrow in the sand sufficiently deep to allow the nets to pass over them. My informant, Mr. W. Brown, assures me that, after the drawing up of the seine, he has taken two or three dozen fine fish from the sand, feeling them with the feet at first, and then simply securing them with the hand; this is probably the origin of the local name of "sand-whiting." The following are extracts from the Report of the Royal Commission, p. 18:—

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* Since the above was written the "Otter" trawl has been used, with more or less success, in the harbour; there can be no doubt that, by trawling, large numbers of these useful fishes could be obtained in suitable places along the coast and in the numerous shallow bays and inlets.

"There are in all four Australian species. The Common Sand-Whiting, *Sillago maculata*, abundant on the New South Wales coast; the Trumpeter Whiting, *Sillago bassensis*, also abundant here; and the most common species in Brisbane is *Sillago punctata*, the Whiting of Melbourne, and rare on this coast." "The first of these, the 'Sand-Whiting,' is by far the most important as an article of food. It is perhaps in more general use even than the Schnapper, constituting almost all through the year the most generally used breakfast fish we have. Of its excellent quality, when in good condition and in the proper season, there cannot be a doubt; but the great favour in which it is held induces, we fear, its extensive use at times when it ceases to be good, and may probably be unwholesome. It is in best condition when it first appears to come in from the sea, about the middle or latter end of summer. It is then a large clean fish, with the roe formed but not full-sized, and it continues in its excellent condition until the roe has attained full maturity or been shed. This occurs generally about March or April. The actual deposition of the spawn has never been observed, but there cannot be a doubt that the sandy and muddy beaches of bays and lakes are the favoured spots. There is a similar want of reliable evidence as to the time of the appearance of the young fry; but we believe that there are sufficient grounds for concluding that the spawn deposited at the end of summer does not germinate until the warmth of spring.

The young fish, and those of all stages of growth short of the adult full-roed fish, seem to reside in the harbours, estuaries, and lakes in which they were born until their departure to the sea; and it is while thus still, as it were, in their nursery that the most improvident havoc is played on them by the fishermen. The age and season of the migration of these fishes to the sea have not been observed, but on their return they are always in considerable shoals." "The Whiting are ground-fish, and, though they are occasionally taken with the hook, they are generally caught in the seine. The 'Trumpeter Whiting' is not in such request as the other, nor is it found in such abundance. The time of arrival from the sea is winter, or a month or two later than the Sand-Whiting. Its habits are much the same in other respects." "There are other genera of *Trachinidæ* found in Australian waters, but none of them having any pretension to utility for food or any other purpose."

SCIÆNIDÆ.

The most important of this family is the Jew-fish (*Sciæna antarctica*), which attains to a large size, exceeding 5 feet in length. (A large specimen may be seen in the collection on exhibit in the New South Wales Court). It is a fish that always finds a ready sale, but when very large the flesh is rather coarse. Our 'Report' remarks, p. 20, that—

"It is said to be very frequently cooked by fishmongers and others and sold as 'fried Schnapper.' It is found at almost all seasons, but most abundantly in summer. It is a deep-sea fish, generally caught with the hook, though young specimens may be occasionally taken in the net inshore." "It has been more than once asserted that this fish is identical with *Sciæna aquila*, the well-known and highly appreciated 'maigre' of the Mediterranean; and Count Castelnau, though originally describing our Jew-fish as a different species, has lately admitted having some doubt on the subject."

"The air-bladder of some of the same genus of fishes is of great value for isinglass, and forms a valuable article of export on the Indian and Malacca coasts, the merely dried bladder being worth equal to 1*s.* 6*d.* per lb. In one of our species—the Teraglin—the air-bladder is of great size and excellent quality, and treated in the same way, that is without any preparation or outlay except that of drying in the sun, would probably add threepence to the value of each fish caught."—R. R. C., p. 20.

The Teraglin (*Otolithus atelodus*), another allied fish of the same family, is in many respects very like the Jew-fish, but does not grow to such a large size, and the flesh is of a finer grain. Like the Jew-fish, it is one of our principal food-fishes, and occurs all the year round, but is more plentiful during the warmer months. Fine specimens of this fish are exhibited in Case No. 3.

POLYNEMIDÆ.

Although three species of this family have occasionally been found on our coast, they cannot be enumerated among our useful fish, being great rarities. Further north, however, in the warmer waters of the Queensland coast, one species of *Polynemus* at least is common, being found plentiful at the mouth of the Burdekin river by one of the employés of the Australian Museum, Mr. A. Morton.

SPHYRÆNIDÆ.

"There are three fishes belonging to this small family occasionally found in Port Jackson and the other inlets of the coast. They are *Sphyræna novæ hollandiæ* and *obtusata* and *Neosphyræna multiradiata*, all of them named. from the elongate muzzle and strong teeth, 'pike,' though in no way related to the well-known European fish of that name. They are very good for the table, but are so seldom brought to the market in any quantity that they are but little known. They are only caught in the seine, and though occasionally taken at other seasons, are most abundant in summer, when they seem to come in from the sea in small shoals."—R. R. C., p. 21.

TRICHIURIDÆ.

The barracouta (*Thyrsites atun*) and the Tasmanian king-fish (*T. soiandri*) are the two principal members of this family that find their way to the markets. The former is the most common, but the latter also occasionally occurs in great shoals. After an absence of several years, shoals of *Thyrsites soiandri* have again visited the Tasmanian coasts. *T. atun* is not so erratic in its movements, and consequently the supply is regular; and when smoked and dried, or salted, forms an article of export to the other colonies. They are large fishes, attaining a length of four feet, and 4 or 5 inches in diameter. Individuals occasionally wander as far north as New South Wales; but the Tasmanian and southern coasts are the homes of these species.

SCOMBRIDÆ.

"This is a very large family, comprising four or five groups of fishes of very different appearance and habit. We will deal with the most numerous, and certainly the most typical, of the groups first, the Scombrina. The genus *Scomber* is represented in Australia by two species, *Scomber australasicus*, Cuv. & Val., and *Scomber antarcticus*, Castelnau. The last-named is the one best-known in these seas as the 'Mackerel.' Like all, or almost all of the 'Scombrina,' it is a gregarious and exceedingly predacious fish, rejoicing in the open sea and generally near the surface, and apparently constantly in pursuit of shoals of other fishes. The instinct which in all fishes seems to compel them to mass together and approach the shore at the season of spawning is not wanting in the kerel, and it is probable that the occasional visits of more than usually large shoals of these fishes is due to this annual movement; at the same time their frequent appearance in Port Jackson at unanticipated times may be owing to the appearance of shoals of other fish which they may have followed up. Be that as it may, it is certain that about midsummer, annually, shoals of enormous magnitude pass near the coast, going apparently in a northerly direction; that the sea has, sometimes for miles, the appearance of being almost a solid mass of them; and that they also have their enemies, and are followed and devoured by shoals of larger fish of their own family if not species, as well as by hosts of other predacious fishes, birds, and mammals. The Mackerel which appear so frequently in Port Jackson, and afford such excellent holiday fishing to the citizens of Sydney, are generally very young, and it is said to be rare indeed to get an adult or full-roed specimen. It is a very good fish when eaten fresh, but, like all the Scombroid fishes, it dies immediately after leaving the water, and decomposes very rapidly, and when eaten in that state it has been known to produce symptoms of fish-poisoning: a most unjustifiable prejudice has been excited against this fish in consequence.

"The 'Bonito' (*Thynnus pelamys*) is also seen occasionally in these seas. It is generally observed in pursuit of shoals of other fish, and it seems to wander about in large shoals, but whether in search of prey or for spawning purposes there is no evidence to show. Another very fine fish—the King-fish of the West Indies, not of Port Jackson—*Elacate nigra*, is also occasionally got here; but it can scarcely be looked upon as more than a chance visitor. There are several other Scombroid fishes on the coast of the same predacious character, and all more or less good for food, but they are essentially ocean fishes, and only enter our harbours when in pursuit of shoals. They belong to the genera *Auxis* and *Cybium*. The 'Pilot-fish' (*Naucrates ductor*) is also a member of this group."—R. R. C., p. 22.

Dr. Steindachner, one of the greatest authorities, is of opinion that our mackerel, *Scomber antarcticus* of Castelnau, is identical with the European species, *Scomber colias* of Linn.

CYTTIDÆ.

Under this family we may mention the John Dorey (*Zeus australis*), considered by some to be the same as the European fish of the same name, *Z. faber*, Linn. This is one of our very best food fishes, always in demand, and bringing a high price in the markets, sometimes as much as 1*s.* per pound; but the supply is so irregular that it can only be looked upon as a rare delicacy. It enters the harbours from the sea to spawn during summer, and frequents the sandy bottoms near reefs. It is only occasionally taken in the seine, but is more often captured by line-fishing with a live bait. When we know more about our coast-line this fish will probably be found in numbers, frequenting the rocky and sandy bottoms adjacent to Port Jackson.

Another member of this family (*Cyttis australis*) takes the place of the John Dorey in the southern markets.

CARANGIDÆ.

This important family supplies us with large quantities of delicious food-fishes, many of which, from their large size, are not so appreciated as they deserve.

The white trevally, *Caranx georgianus*, which on the New South Wales coast is seldom taken weighing over 1½ to 2 lbs., is found on the shores of Queensland of a much greater size, not unfrequently reaching 5 to 6 lbs., and affords fine sport to line-fishers; it is also taken with the seine in large quantities. The bait used in line-fishing is a blue-bodied crab (*Mycteris*, sp.) Very young fish are sometimes taken in the trawl and seine in Port Jackson.

The yellow-tail, *Caranx declivis*, of Richardson, now generally admitted to be the young of *Trachurus tra-*

churus, is very abundant in all parts of the harbour; it is always in demand for bait, but is also a good edible species. Adults, reaching a length of 15 inches, are occasionally taken on the coast, and sometimes also far up the harbour during the spawning season.

"There are very many species in Australian waters, their numbers increasing rapidly towards the warmer seas of the north. Those best known to the fishermen of Port Jackson are—the 'Yellow-tail' (*Trachurus declivis*), the 'White Trevally' (*Caranx georgianus*), the 'King-fish' (*Seriola lalandii*), the 'Samson-fish' (*Seriola gigas*, Gth.), and 'The Tailor' (*Temnodon saltator*). The first of these, the 'Yellow-tail,' is almost, if not quite, identical with the 'Horse Mackerel' of Europe (*Trachurus trachurus*). In the young state it is abundant at all times in Port Jackson, and is in great demand for bait. The adult fish is seldom seen in the harbour, but it is said to pass along the coast in large shoals at or about midsummer. It is most probable that this fish spawns in the inlets and harbours of the coast, from the fact that the young fish of from five to six inches in length are always to be found in such localities. The very young fry have a most extraordinary and ingenious way of providing for their safety and nutrition at the same time; they take up their quarters inside the umbrella of the large *medusæ*, where they are safe from their enemies, and are, without any exertion on their part, supplied with the minute organisms which constitute their food, by the constant current kept up by the action of the curtain-looking *cilia* of the animal."—R. R. C., pp. 24, 25.

"The 'White Trevally' is very abundant at times in the harbours and inlets of the coast, but generally in a young state. The adult fish is large, and appears in summer in very large shoals.

"The 'King-fish' is about the most voracious and destructive of all the predacious fishes of these seas. It grows to a large size, congregates in enormous shoals, and habitually pursues and destroys the shoals of other fish at all smaller than itself. It is not considered a very good fish.

"Of the 'Samson-fish' very little has been observed. It is a large and handsome fish, and affords good sport to the amateur fisherman.

"The 'Tailor,' is well known in Port Jackson. The young fish are constantly making their appearance in shoals in the summer season, and are taken in the seines in great numbers. They are much in demand for bait, but are not a favourite catch for the fishermen, as they are most destructive to the nets. The adult fish are large, and are known in the Melbourne market by the name of 'skip-jack.' They school in midsummer, move in enormous shoals, and are said to be most destructive to the young and spawn of other fishes. As an article of food they are not in much request, but when fresh there are few more delicate and well-tasted fish." —R. R. C., pp. 25, 26.

Neptomenus travale and *N. brama* are good food-fish, but rare in Port Jackson. To the south, however, they are more common, and reach to a considerable size, weighing from 5 to 10 lbs.

MUGILIDÆ.

"A very wide-spread and valuable group of fishes, amply represented in Australian waters. The best-known species in New South Wales are the 'Sea-Mullet (*Mugil grandis*, Castelnau); the 'Flat-tail Mullet' (*Mugil peronii*, Cuv. & Val.); the 'River' or 'Hard-gut Mullet' (*Mugil dobula*, Günther); and the 'Sand-Mullet' or 'Talleygalann' (*Myxus elongatus*, Günther). There are other species, such as *Mugil cephalotus*, *petardi*, *compressus*, *argenteus*, and *acutus*; but they are rarely seen and little known, and not therefore classifiable as useful fishes. The first of this list, the Sea-Mullet, is a large fish attaining when full grown a length of 2 feet. It is unsurpassed in richness and delicacy of flavour by any fish in the world, the Salmon not excepted; and it offers itself for our use in countless numbers at the very season when it is in the best possible condition. The history of this fish is now pretty well known, though it will be seen by a perusal of the large amount of evidence printed in the Appendix, that there are many very conflicting statements and opinions given."

"To begin with the spawning season:—In the latter end of summer, that is at periods varying from the middle of March to the middle of May, the Sea-Mullet is seen to enter all the harbours and inlets of the coast in successive shoals, some of the most astonishing vastness. It is then full of roe, and in splendid condition. When not interfered with by fishermen (for it is a fish easily turned from its course) or diverted by storms or floods, these shoals penetrate to all parts of these inlets, and run up the rivers even into fresh water in search of suitable places for the deposition of their spawn. When a suitable spot is reached, the deposition of the spawn commences; and the process is carried on in much the same way as that of the Salmon and other fish of similar habits. Sometimes, however, from bad weather or the persecution of fishermen, the shoals are prevented from seeking suitable spawning grounds, and the fish, being no longer able to retain the spawn, shed it loose upon the water, where it becomes entirely lost. When the ova are properly fertilised and left undisturbed the young fish make their appearance on the approach of warm weather in spring (Macleay), when they may be seen in large shoals close to the land and in shallow water. From that period until they become adult, which is probably at the age of two years, they seem to keep entirely to the rivers, lakes, and mud-flats, where they thrive and grow with amazing rapidity. As they are without teeth, they are incapable of eating either animal or vegetable substances in the ordinary sense of the term; but they are possessed, Dr. Günther informs us, of a pharyngeal apparatus which sifts the organic from the inorganic particles from the mud which they swallow and on which they live. When the period at length arrives for the mature fish to go to the sea preparatory to spawning, the instinct which actuates them seems to be irresistible. In one instance, some years ago, when Tugerrah-beach lake was for a time shut up at its sea-mouth, the Mullet pressed in such masses in the direction in which the outlet should have been that thousands of them were forced up on the land and perished. An occurrence of the same kind is mentioned as having happened at Lake Illawaira under similar circumstances. It is doubtful how long it is between the rush of the fish to the sea and their re-entrance into the same or other rivers; the belief is that the time is very short, that the movement is only from one opening of the coast to another, and always from south to north. There can be little doubt that the fish, after spawning, find their way back to their old haunts; but they have very seldom been seen so returning. The spent fish are for a time unfit for food, but they improve in condition very rapidly. The only instrument of capture used for the Mullet is the seine-net. The range of the species is from the Gippsland lakes on the south up to Brisbane on the north." The weight of a full-grown sea-mullet is from 6 to 8 lb., sometimes more. If preserved and tinned, this fish would form a valuable article for export as well as for home consumption. It is much to be regretted that no tinning establishment exists in Australia, and too often this fine fish is taken solely for its oil and roe; the latter, slightly smoked and dried, is considered a great delicacy.

"The Flat-tail Mullet is also a very good fish, but has neither the size nor the extreme excellence of the Sea-Mullet. It appears also at the end of summer or beginning of winter, and spawns in our bays and creeks; but the shoals are never of the same enormous size as are common with the other.

"The other species (*M. dobula*) is, except at the schooling season, almost a freshwater fish, living as high up the streams as it can get; but it cannot, like the European salmon, pass up rapids or falls. It is a good fish, but inferior to both the others. The term 'Hard-gut Mullet' is sometimes applied to this species, but more frequently the fishermen apply that name to immature specimens of the 'Sea-Mullet.' It is sometimes taken by the hook.

"The 'Sand-Mullet' (*Myxus elongatus*) seldom exceeds seven or eight inches in length; and though no doubt excellent eating, as are all the family, is looked upon as too small for the market."—*R. R. Com.*, pp. 27–30.

LABRIDÆ.

The most important of this group is the blue groper (*Cossyphus gouldii*), a valuable and delicious fish, attaining 'arge size, and often 20 to 30 lbs. in weight. The head and shoulders of this fish, says our Report, "makes the most delicious dish one can conceive." Half-grown fish are usually taken in the seine, the adults by line-fishing, or with the trammel-net set near the rocks.

Another common species is the "Maori" (*Coris lineolatus*), a most varied and beautifully marked fish, of a rich vermilion, longitudinally banded with broad bands of dark violet and pink, and elegantly ornamented with bright blue lines on the head. It frequents the rocky shores and weeds, among which the young fish take refuge. *Labrichthys laticlavius* is sometimes obtained. *Odax semifasciatus* known locally as the "rock-whiting," "stranger," &c., is more often found. Other members of the Labridæ occasionally are taken, but do not afford any supply worthy of mention. The same may be said of the "pig-fish" (*Cossyphus unimaculatus*), which is frequently seen; it is a bright-coloured fish, of a rich red, with a blackish spot about the centre of the dorsal fin, and occasionally two black longitudinal markings on the side of the body.

GADIDÆ.

This family, so largely represented in the Northern hemisphere, is almost wanting in the Australian seas. It is represented by only three or four species, which may be looked upon as food-fish, belonging to the genera *Lotella* and *Pseudophycis*. *Lotella grandis* is the largest species, and not usually found. *L. callarias* and *L. rubiginosa*, known as the beardie and the ling, are the only other species which are marketable, and even these are only occasionally found. *L. callarias* and *L. grandis* are delicious food-fish, but require to be cooked while fresh, soon decomposing after death.

PLEURONECTIDÆ.

Although we have no less than ten species of flat-fish inhabiting Port Jackson, the supply is meagre and uncertain; in fact, the only species which afford us articles of food are *Pseudo-rhombus russellii*, *P. multimaculatus*, *Arnoglossus bleekeri*, all of which are known locally as flounders, and the sole (*Synaptura nigra*, Macleay). The former are tolerably good fish; the latter is a great delicacy, far superior to any sole, brill, or flounder that comes into the English market. Having recently made the experiment, I may be permitted to speak confidently on this subject. Two other very delicious fishes, although found only during the summer months, are *Solea macleayana* and *S. microcephala*. The latter is seldom met with in any quantity; the former, only lately discovered, inhabits also the freshwater streams. Two other species, *Lophonectes*, sp. n., and *Tapirisolea*, sp., have been recently brought up by the trawl. It is not unlikely, when trawling is resorted to in the waters of Port Jackson and the adjacent coast, that we shall have a regular supply of the most delicious food-fish. It may interest the naturalist to know that the following species frequent the harbour of Port Jackson:—*Pseudo-rhombus russellii*, *P. multimaculatus*, *Tapirisolea*, sp., *Arnoglossus bleekeri*, *Tetrorhombus excisiceps*, *Synaptura nigra*, *Solea macleayana*, *S. microcephalus*, *Lophonectes* 2 sp., *Pardachirus pavoninus*, *Plagusia unicolor*. The last-named is known under the name of the lemon sole; it is of a pale olive-yellow when alive. To the southward are found *Rhombosolea monopus* and *Ammotretis rostratus*, both good table-fish.

The flounders in Port Jackson are occasionally taken in the seine, and sometimes in the trammel-net when set across a sandy spit as the tide is falling, out usually with the hook and line, small prawns or shrimps being the baits used. The soles (*Synaptura nigra*) do not take the bait; and although a few may occasionally be taken in the seine, the usual mode is by spearing them. On a clear calm morning the fisherman allows his boat to drift with the tide, or poles it along with his spear over the shallow sandy flats on which these fish abound or frequent to spawn. A practised eye will soon discern the shape or outline of the fish covered in the sand, with usually only its eyes exposed. When disturbed, and as it settles down again in the sand, a slight cloud is thrown up, which indicates its whereabouts. The fish is easily speared, and several dozen may be obtained in two or three hours or less time.

Recently, by trawling, many individuals, both of flounders, soles, and other flat-fish have been obtained. The colours of these fish vary in accordance with the colour of the ground they frequent; some are of a light olive or ashy brown from a sandy bottom; others of a jet-black colour when taken off the mud.

SILURIDÆ.

In Australia many species of this family abound, the most common being *Cnidoglanis megastoma*, found on all the muddy flats in the harbours in the neighbourhood of Port Jackson. It is generally brought up in the trawl, but approaches the shore more often at night, when it is frequently taken in the seine. It is seldom brought to market, Europeans having an undue prejudice against eating it.

Another species, *Copidoglanis tandanus*, is plentiful in the rivers, and will be noticed under our Freshwater Fishes. Both are rich and good-flavoured food-fishes.

SCOPELIDÆ.

This family affords us but three species, one only being worthy of mention; the others, of the genera *Saurus* and *Saurida*, must be looked upon as comparatively scarce fish. The "Sergeant Baker," *Aulopus purpurissatus*, is the species usually found in the market, and by some considered a delicacy. In taste and grain the flesh resembles the English whiting, but has a much better flavour, if the latter can be said to have any flavour at all. It attains the length of 18 inches, and is a highly coloured and beautifully marked fish, of a deep red hue; the fins opalescent and strongly marked with deep red spots and blotches; the flesh is white, large in grain, and rather dry. It is occasionally taken in the seine, but more often in deep water with the hook and line.

SCOMBRESOCIDÆ.

Five or six species of this family frequent the harbour of Port Jackson and coast-line of New South Wales, but only three of them deserve notice. The most common are the two species of gar-fish—*Hemirhamphus intermedius* (the sea gar-fish), and *H. regularis* (known as the river gar-fish). The former (*H. intermedius*) comes in from the sea in immense shoals, is a universal favourite with all classes; no breakfast table should be furnished without it. The other, *H. regularis*, is similar in every respect, but by some considered the better fish. The flesh of both, before cooking, is semitransparent, with a silver stripe along the ral line; when cooked it is as white as snow, and of the most delicious flavour, having no bones of any size but the back series; it may be eaten without that attention which is due to other fish in this respect. The following extract is from the Report of the Commissioners:—

> "The ordinary Sydney Gar-fish comes in from the sea in the latter end of summer, to deposit its spawn in suitable spots in the harbour. It is then in the finest condition, and makes its appearance in successive shoals, some of them of enormous size. During the latter end of February of this year (1880) the shoals were so large that several boat-loads were taken in one haul of the seine, and the fish on the spot could be purchased for *sixpence a bushel.* The 'Long Tom' (*Belone ferox*) is also of this family; it is a good fish, but not so fashionable as the Gar-fish, and, like it, is taken only in the net."—*R. R. Com.*, pp. 33, 34.

Other species, as *H. commersoni*, *H. argenteus*, are rare with us, and recently *Scomberesox forsteri* has been taken in Port Jackson. *Belone ferox*, the "Long Tom" of the fishermen, "green-bone," and "gar-fish" of Europeans, is also a good table-fish; it is seldom taken with the line, but at times in considerable number with the seine. It reaches the length of 4 feet, but is usually found about 2½ to 3 feet long; it has not the delicate flavour of the gar-fishes (*Hemirhamphus*). There are three or four species of *Belone* on our coast, all known under the name of "Long Toms" by the fishermen. One species (*Belone kreftii*, Gthr.) inhabits the fresh waters of Queensland.

CLUPEIDÆ.

No less than ten species of this family inhabit the Australian waters, all of which have been recently revised and described by the Hon. W. Macleay, in vol. iv., p. 363, of 'The Proceedings of the Linnean Society of New South Wales.'

"We will therefore only notice here those which appear to be most abundant and most likely to be useful. The 'Maray' (*Clupea sagax*) appears annually in immense shoals about mid-winter, passing in a northerly direction; and portions of the shoals sometimes enter the bays and harbours of the coast, but not certainly, as with most fishes, for the purpose of spawning, for the shoals consist at that time of small and immature fish, but probably driven in by the hosts of large fishes, porpoises, &c., by which they are invariably pursued. The same fish is seen to pass south on the eastern coast of New Zealand about six or seven months afterwards, and then they are full-grown and full of roe. The excellent bloaters of Picton, New Zealand, are made of this fish. The next best known species is the 'Herring (*Clupea Sundaica*). a fish of great excellence and delicacy of flavour, though but little appreciated. It also appears in the winter season, and in shoals. It is said to be found about the mouth of the Hawkesbury River at all seasons of the year."—*R. R. Com.*, p. 34.

Etrumeus jacksonensis is another delicious food-fish, which is occasionally taken in the harbour. In March, 1883, both *Clupea sagax* and this species were found in good condition, and taken in the same haul of the seine.

MURÆNIDÆ.

Eels are abundant in our waters, but are only occasionally brought to the market, not being specially fished for. They are not much in demand, and seldom bring more than *6d.* or 1*s.* each, or from 3*d.* to 4*d.* per lb. Recently there has been a slight demand, while formerly they were almost unsaleable. The species most frequently obtained are:—*Anguilla australis*, usually from the fresh-water swamps, lagoons, and rivers near Sydney; *Murænesox cinerea*, the "pike eel," "silver eel," &c; *Ophichthys serpens*, the sand-eel; *Conger labiata* and *Muræna afra*, the "rock" and "green" eels, which are common on all the reefs and rocky parts of the harbours. *Murænesox cinerea* is the largest, attaining a length of 6 feet; it is found in tidal rivers, both in fresh and salt water. *Anguilla australis* also grows to a great size, seldom reaches 5 feet in length, but is often 10 inches in circumference; it is a most delicious fish, and abounds in all the rivers, pools, and lagoons on the eastern watershed. Other species, as *Myrophris australis* and *Muræna nebulosa*, are sometimes taken. Eels are highly esteemed in other countries, and when our waters are properly fished they will supply largely a valuable article of food.

SCLERODERMI.

The "leather jackets," *Monacanthus*, are the only members of this family used as food, and against these even there was an undue prejudice, which is gradually dying out. *Monacanthus ayraudii M. hippocrepis M. granulosus*, Richardson, are really good table-fish, but they all require skinning before being cooked; the young of all three species are very plentiful, and not being a marketable fish are looked upon as the reverse of useful by the fishermen. The adults of *Monacanthus ayraudii* are a serious drawback to line-fishers, especially when engaged in Schnapper-fishing, cutting the lines near the surface of the water. As our Report remarks, "unless some means can be found of getting rid of this pest, Schnapper-fishing will have to be conducted with wire lines."

CHONDROPTERYGII.

SHARKS AND RAYS.

Although the waters of Port Jackson and our coasts abound with these scavengers, but little use is made of them; they are seldom sought for, and when occasionally taken are seldom made use of, notwithstanding a large amount of valuable oil can be obtained from the livers, and the fins find a ready sale among the Chinese.

Dried fins of various species and samples of the oil from the livers of four of the most common kinds may be seen in the Court. The following is a list of the species found in Port Jackson, many of which attain a great size:—

SHARKS.

1. **Carcharias gangeticus,** *Müll. & Henle.*
2. **Carcharias macloti,** *Müll. & Henle.*
3. **Carcharias brachyurus,** *Günther.* Whaler.
4. **Galeocerdo rayneri,** *McD. & Barr.* Tiger-Shark.
5. **Galeus australis,** *Macleay.* School Shark.
6. **Zygæna leeuwinii,** *Dum.* Hammer-headed Shark.
7. **Mustelus antarcticus,** *Günther.*
8. **Lamna glauca,** *Müll. & Henle.* Blue Pointer Shark.
9. **Carcharodon rondeletii,** *Müll. & Henle.* White Pointer Shark.
10. **Odontaspis americanus,** *Mitchel.* Grey Nurse.
11. **Alopecias vulpes,** *Linn.* Thrasher.
12. **Notidanus indicus,** *Cuv.*
13. **Scyllium maculatum,** *Bl.*
14. **Chiloscyllium furvum,** *Macleay.* Dog-fish.
15. **Crossorhinus barbatus,** *Linn.* Wobbegong.
16. **Heterodontus philippi,** *Lacép.* Port-Jackson Shark.
17. **Heterodontus galeatus,** *Günther.* Port-Jackson Shark.
18. **Acanthias megalops,** *Macleay.*
19. **Rhina squatina,** *Linn.* Angel Shark.
20. **Pristiophorus cirratus,** *Latham.* Saw-fish Shark.

RAYS.

The side fins of the Rays are used as food in many parts of the world, but, as yet, not in Australia; even the Skates despised as unfit for food. Notwithstanding this, they are quite as palatable as any Skate sold in the London markets.

The following is a list of the Rays found in the harbour of Port Jackson, all of which, with the exception of *Hypnos subnigrum*, are edible :—

Rhinobatus granulatus, *Cuv.*
Trigonorhina fasciata, *Müll. & Henle.*
Hypnos subnigrum, *Dum.*
Raiia lamprieri, *Rich.*
Trygon pastinaca, *Linn.*
Trygon tuberculata, *Lacép.*
Urolophus testaceus, *Müll. & Henle.*
Myliobatis aquila, *L.*
Myliobatis australis, *Macleay.*
Ceratoptera alfredi, *Krefft.*
Dicerobates, sp.

FRESHWATER FISHES.

PERCIDÆ, &C.

The so-called "Murray Cod" or "Macquarie Cod" (*Oligorus macquariensis*) is the largest of our freshwater fishes, sometimes weighing over 100 lbs. When at a weight of from 3 lbs. to 10 lbs. it is considered most marketable, and is without doubt a most delicious fish. It abounds in most of the rivers north of Sydney and in those of the western watershed, as the Murray and Macquarie and their numerous tributaries, affording good sport for anglers and a valuable supply of good food; they are usually taken for market with a Trammel, or Bag-net, set across the stream, or by hook and line. They have been introduced into several of the inland lakes near Sydney, such as Lake George, Lake Bathurst, &c., where they thrive remarkably well, becoming immense fish and exceedingly fat. A large specimen, which weighed about 20 lbs., is exhibited in front of case No. 3.

Large quantities are daily, during the cold months, sent to the Melbourne and Adelaide markets from the Murray and its numerous tributaries; the supply for the Sydney markets is obtained from Lake George and from the Macquarie River, but chiefly from the Murrumbidgee, being forwarded by train from Wagga.

Two species of Murray Cod are recognised by naturalists, the *Oligorus macquariensis*, Cuv. et Val., and *Oligorus mitchelli*, Castelnau.

The next fishes of importance, all of which are considered great delicacies, are the Golden Perch, *Ctenolates ambiguus* (*Dules auratus*, of Richardson), *Ctn. chrystii*, Cast., and *Ctn. flavescens*, Günth. *C. ambiguus* is found in considerable numbers in the Victorian fresh waters and at Wagga on the Murrumbidgee. *C. flavescens* equally plentiful, is, I believe, confined to the upper waters of the Macquarie in New South Wales; here also we have the Silver Perch (*Therapon richardsoni*, Cast., and *T. macleayana*, Ramsay) in considerable numbers; and although usually taken for the markets with the net, they afford good sport to the angler—from twenty to forty fine fish, weighing from ½ to 6 lbs. weight, may easily be secured by one person in a day's fishing within a few miles of the town of Wellington.

Among other fishes equally good may be mentioned *Therapon niger*, Cast., *Murrayia güntheri*, Cast., *M. cyprinoides*, Cast., *M. bramoides*, Cas., *Riverina fluviatilis*, Cast., *Macquaria australasica*, Cuv. et Val., and others which occasionally find their way into the southern markets.

Lates colonorum of Günther forms a good article of food; it inhabits most of the rivers, lakes, and lagoons throughout the whole of Australia, but is replaced in the northern rivers by a much larger species known as *Lates calcarifer*, which is more abundant.

L. colonorum is not unfrequently taken with nets in the bays at the estuaries of the rivers, having been brought down to the sea by the "freshes" or floods, also by "set" nets in the rivers higher up the stream. When freshly cooked they are among the best of our river fishes. They spawn during August and September, the roes being considered a great delicacy. There are many other species, such as *Lates Ramsayi*, MacLeay, *Lates curtus*, Cast., *Mugil dobula*, Gth., *Mugil argenteus*, Eels (*Anguilla australis*, the freshwater Herring (*Meletta novæ-hollandiæ*), the Cat-fish (*Copidoglanis tandanus*), and a host of small fry which afford the anglers pleasant sport as well as a good dish.

But the most important of our freshwater fishes are undoubtedly the two species of the Murray Cod (*Oligorus*), the Golden Perch (*Ctenolates*), 2 species, the Silver Perch and MacLeay's Perch (*Therapon*), the River Perch (*Lates*), 2 species, with the Eels (*Anguilla*), of which there are also probably 2 species.

EDIBLE MOLLUSCA.

OYSTERS.

(Ostrea glomerata, O. virescens, O. subtrigonia, *Sow.*,
O. mordax, *Gld.*, **O. edulis,** var. **purpurea,** *Hanley.*)

A large collection of Oysters, in numerous varieties, and from beds in different localities. Most of these beds are natural beds, very few of them formed by artificial layings; all are under lease, and more or less under cultivation.

The Rock-Oysters, although usually known under several different names, are now by most conchologists admitted to be only localised varieties of one and the same species, *Ostrea glomerata.* If we accept this view, then we have only two species which are used as articles of food—*O. glomerata*, in its many varieties, and *O. edulis*, L., *O. purpurea* being only a variety of the latter, which is identical with the small form known as the "Native" in the London markets.

Ostrea sp. (No. 69), from Coffin's Bay in South Australia, is another variety of the same species found in the Adelaide market, and frequently producing irregularly formed pearls of large size but of no commercial value.

Ostrea virescens is a rare species, only occasionally found at very low tides on some of the numerous islands in Port Jackson. Other species (*O. crista-galli* and *O. imbricata*) were obtained by Mr. A. Morton at Port Denison, Queensland; and the "Hammer-head Oyster" (*Malleus albus*, Lam.), &c., are found on our coasts, but do not find their way into the market as articles of food.

The following collection, from 70 different beds and localities, is exhibited to show the numerous forms which our *Ostrea glomerata* assumes in various places, and the great wealth which may be developed by proper legislation, administration, and cultivation of the oyster-beds in N. S. Wales.

Recent experiments tend to prove that the Rock-Oyster of our shores (Nos. 10, 28, 40, 67), which is left dry by every tide, is only a variety of the Drift-Oyster; and spat taken from the rocks at low tides, when laid in beds always covered by the sea, are said to thrive well; and although Oysters may thrive on natural beds of ***mud and sand***, whenever these beds are over-dredged the animals become diseased by the infiltration of mud into the shells. Steamer traffic over the shallow water-beds of the Hunter River, formerly so prolific, has in many cases either deteriorated or completely destroyed them (see examples of this in specimens No. 63). The black mud stirred up by steamer traffic, and brought down by the tides or "freshes" in the river, has infiltrated into the shell; the animal, unable to get rid of it, has deposited a layer of nacre over it time after time, until the shell has become formed of thin layers of mud and nacre, and the animal becomes exhausted, diseased, and dies. That natural Oyster-beds can and are, in fact, being destroyed daily by over-dredging, and by traffic when situated in shallow waters, in other countries as well as in Australia, must be patent to any one who has taken the trouble personally to examine into the subject. It is also clear, from the numerous specimens exhibited from our waters, that the depth up to 10 or 15 feet is not material, although the best Oysters are obtained from the shallowest beds, and are grown on a rough shelly, gravelly, or stony bottom. The most highly prized in New South Wales are those from the rocks or beds where the fresh and salt water mingles at certain seasons of the year; for instance, at the estuaries of the river and vicinity of fresh-water creeks (see specimens No. 10). The value of Oysters in Sydney is from 4*s.* to 10*s.* per bushel, and are retailed at 6*d.* to 1*s.* per dozen.

Those who are desirous of obtaining further information on this subject will do well to consult the Reports of the Royal Commission on the (Oyster) Fisheries of N. S. Wales, 1877, 1880, &c., and the 'Proceedings of the Linnean Society of New South Wales' for the last two or three years (1881 to 1883), where several interesting Papers will be found on the subject by Dr. J. C. Cox, F.L.S., the Rev. J. E. Tenison-Woods, F.L.S., and Mr. John Brazier, C.M.Z.S.

Newcastle Oysters, Hunter River.

No. 1. From the main channel known as the Bluff Bed: depth of water from 1 to 24 feet.
2. From the Beaton Bed; depth of water from 4 to 15 feet.
3. From the western side of the Channel; part of it becomes dry at low water; the deepest part of it is about 8 feet.
4. From the western side of the Channel: part of it becomes dry at low water; the deepest part of it is 5 feet.
5. Is from the first bed in Fulerton Cove on the east side of the Bay; depth of water from 1 to 20 feet.
6. Is from the next bed on the west side of the Channel; depth of water from 6 to 15 feet.

Hawkesbury-River Oysters.

No. 7. From Browera Creek. Natural "Dredge Oysters." Length of bed 10 miles, 4 to 8 or 10 feet wide, with depth of water 4 feet in some places, at others from 10 to 12 feet at low water.
8. From "Muna Muna" Creek. Cultivated Oysters, laid on an artificial bed, under cultivation, at the entrance, in Feb. 1882, have improved very well; depth of water 5 feet at low water.

9. Cultivated Oysters, laid in March 1882 on a bed, at the entrance to Mooney Creek, in 3 feet of water at low water, have not done so well.
10. The very best Rock-Oysters; *dry at low water*, very scarce, and bring the highest price in the market when obtainable.

Manning-River Oysters.

No. 11. From Harriett's Bed; 100 yards long and 10 to 12 yards broad; depth of water 8 feet. This bed is now completely exhausted, the bottom being of black muddy sand; destroyed by over-dredging.
12. From Blackbutt's Bed; 150 yards long and 10 to 12 yards wide; depth of water 12 to 20 feet; bottom same as above.
13. From mouth of Graham's-Creek Bed; 150 yards long, 4 to 8 yards wide; depth of water 4 to 8 feet.
14. From Lee's Bed; 300 yards long, 60 to 70 yards wide; depth of water 5 to 12 feet; rocky bottom, irregular.
15. From Owen Smith's Back Bed; 300 yards long, 60 yards wide, depth 4 to 12 feet; bottom very rocky and irregular.
16. From Shubert's Bed; 300 yards long, 70 yards wide, depth 2 to 12 feet.
17. From P. Smith's Bed; 300 yards long, 10 to 20 yards wide, depth 4 to 20 feet.
18. From Scott's Creek Bed; 250 yards long, 20 yards wide depth 2 to 10 feet; rocky bottom.
19. From Catton Bed; length 200 yards, breadth 60 yards; depth of water from 3 to 20 feet; bottom—sand, clay, and mud.
20. From McDermid's Bed; length 500 yards, breadth from 50 to 60 yards; depth of water from 5 to 16 feet; bottom rocky.

Clarence-River Oysters.

No. 21. From the House Bed; depth of water 3 feet.
22. From the House Bed; depth of water 6 feet.

23. From the House Bed; depth of water 17 feet. The House Bed is the most important of the Clarence-River Oyster-beds.
24. From Rotgut Bed; depth of water 3 feet.
25. From Rotgut Bed: depth of water 16 feet. The Oysters from this bed have had an indifferent reception in the market, and the bed has accordingly received its peculiar name. The bed was well worked last year (1881), and it is supposed that it is on this account that the Oysters are this season (December 1882), for the first time free from the objectionable defect from which the bed takes its name.
26. From Captain Dick's Bed; depth 4 to 6 feet in the Lake Channel; with an area of about 3½ acres; and produces the best quality of Oysters.
27. From the Mud Patch; depth 12 to 14 feet. It is a small bed, interrupted in places with mud patches, hence its name.
28. Rock-Oysters, taken from the stones on the inner side of the dyke at the Clarence Heads.
29. From Brodie's Bed; depth 3 to 6 feet.
30. From Brodie's Bed; depth 16 feet. Contains an area of about 8 acres.
31. From Lake Bed, which covers an area of 7 acres, and is said to have been one of the finest beds in the Clarence River; several portions of it have been covered by shifting sand; depth of water 8 to 4 feet.

Moruya-River Oysters.

No. 32. The Beds extend about half a mile on each side of the river, and are covered with from 8 to 12 feet of water.

Shoalhaven-River Oysters.

No. 33. Bed 300 yards from the mouth of Broughton Creek, and about 200 yards long; depth of water from 10 to 16 feet; rocky bottom.

34. Bed about 400 yards from Broughton Creek; about 150 yards long; depth of water 12 feet; rocky bottom.
35. Bed about 100 yards long; depth of water from 7 to 14 feet; rocky bottom.

Jervis-Bay Oysters.

No. 36. Currambene Creek, the bed is about 2 miles from the mouth of the Creek; about 150 yards long; depth of water from 5 to 10 feet; rocky bottom.
37. Currambene Creek; bed about 300 yards from the abovementioned bed; about 200 yards long; depth of water from 5 to 12 feet; rocky bottom.
38. From Bherrewerre; the length of the bed is about 200 yards; depth of water from 4 to 9 feet; rocky bottom.

Crookhaven-River Oysters.

No. 39. Bed worked out; depth from 6 to 8 feet; bottom, shells.
40. Rock-Oysters from the Dyke, Crookhaven River.

George's-River Oysters.

No. 41. O'Connell's Oyster-Bed dredging-ground; length of bed about 400 yards, width about 40 yards; depth of water 10 to 20 feet.
42. Oven-Reach Bed; about 20 chains long; width of bed about 25 yards; depth of water 20 to 30 feet.
43. Punt-Reach Bed; about 150 yards long, width about 20 yards; depth of water about 10 to 15 feet.
44. "Big Half-Moon Bed;" about 100 yards long, width about 20 yards; depth of water about 20 to 25 feet.

Richmond-River Oysters.

No. 45. Known as the Upper Bed; dredged from the depth of 7 feet.
46. Taken from a mud-flat left bare at low water.
47. Rock-Oysters taken from the rock at the Pilot Station, Richmond-River Heads.

Clyde-River Oysters.

No. 48. Sample from 14 to 20 feet depth of water; bottom shelly and shingly.

49. Sample from 25 to 35 feet depth of water; bottom, hard slaty bed with large loose rock.

50. Sample from 12 to 20 feet depth of water; bottom gravel and shell.

51. A hard rock-bed with large loose stones; depth of water about 40 feet.

52. Soft shingly rock-bed of a yellow colour; depth of water about 14 to 20 feet.

53. Shell and shingly bed, with a rocky shore; depth of water about 20 feet.

54. Hard rocky bottom; depth of water about 60 feet.

55. Hard slaty-rock bed; very few shells; depth of water about 40 feet.

56. Soft yellow-rock bed; no shingle; depth of water from 14 to 20 feet.

Camden-Haven Oysters.

No. 57. "Stinker's Creek;" depth of water 6 to 10 feet, with pipe-clay and ironstone bottom covered with oyster-shells and sandy mud.

58. Lower Bed, Maine River; depth of water 10 to 13 feet, with broken shells and sandy mud bottom.

59. Middle Bed, Maine River; depth of water 6 to 10 feet, with shells and sandy mud bottom.

60. Known as the upper or top bed, Maine River.

61. The upper or top bed, Maine River; depth of water from 6 to 9 feet, with oyster-shells and silty bottom.

Lake-Tuross Oysters.

No. 62. TRUE MUD-OYSTER.

Ostrea edulis, Linn., var, *purpurea*, Hanley; *O. Angasii*, Sowerby.

Sample of Newcastle Oysters, being destroyed by steam traffic in the river.

No. 63. These oysters are being destroyed by the large quantity of silt spreading over the natural Oyster-bed; they only live a few days after being taken from the water, and even when freshly-opened the animal is of a dirty-white colour, and quite unfit for food.

Cape-Hawke Oysters.

No. 64. This is the so-called Drift Oyster of the Sydney Oystermen *Ostrea subtrigona* of Sowerby.

An overgrown form of *Ostrea glomerata*, Gld.

Lake Cutgee, near Bermagui.

No. 65. TRUE MUD-OYSTER.

Ostrea edulis, Linn., var. *purpurea*, Hanley: *O. Angasii*, Sowerby.

Auckland, New Zealand.

No. 66. ROCK-OYSTER.

Ostrea glomerata, Gld.

Cape Upstart, Queensland.

No. 67. ROCK OYSTER.

Ostrea mordax, Gld. Variety of *Ostrea glomerata*, Gld.

No. 68. THE TRUE MUD-OYSTER.

Ostrea edulis, Linn., var. *O. purpurea* (Hanley); *O. Angasii* (Sowerby).

From Port Jackson.

No. 69. A variety of the MUD-OYSTER (*O. edulis*, L.), from the South Coast of Australia, about 130 miles west of Adelaide, near Coffin's Bay; hard limestone bottom, no mud.

This variety produces pearls, but of no commercial value, (Obtained from Messrs. Taylor Brothers, Adelaide.)

No. 70. Ostrea virescens, *Angas.*

A rare species found at very low tides on some of the small islands in Port Jackson. (From Mr. Brazier's collection.)

COLLECTION OF OTHER EDIBLE MOLLUSCA.

1. **Haliotis nævosa,** *Mart.*

The "Mutton-fish," or Ear-shell as it is sometimes called, was once very abundant on our coast, and is still plentiful on certain unfrequented parts. It is considered a great delicacy by the Chinese, by whom it is chiefly used, and worth from 10*d.* to 1*s.* per lb.

1 *a.* Animal dried; 1 *b.* Animal dried and salted; 1 *c.* The shell as used for making ornaments, &c.

2. **Ninella straminea,** *Mart.*

Found under ledges of the rocks at low water, and still tolerably plentiful in the neighbourhood of Port Jackson. With other shellfish they formed one of the chief articles of food in the early days of the aborigines, and are still eaten by some of the colonists; when boiled slowly or steamed for a considerable time, the animal becomes soft and is easily extracted from its shell. The shells are used for ornaments when polished, and in the manufacture of buttons. Zoologists may be interested in the fact that a small parasitic crustacean is sometimes found imbedded in the integument of this species.

3. **Trochocochlea tæniata,** *Q. et G.*
4. **Tectarius pyramidalis,** *Quoy.*
5. **Littorina mauritiana,** *Lam.*

These, known under the name of "Periwinkles," are occasionally eaten, being sold in the streets to the juvenile members of the community. They are found in considerable numbers on the rocky shores all along our coasts.

6. **Potamides ebeneum,** *Brug.*

This is a much larger animal than any of the preceding, and, although frequently eaten, is more often used as bait by amateur fishermen. It abounds on the extensive mud and sandy flats of Port Jackson and other inlets of the coast, and may be gathered in quantities at low tides.

7. **Triton australis,** *Lam.*

Formerly plentiful in crevices under shelving rocks on the seaboard. Seldom used as food, perhaps from its scarcity. It is a fine handsome shell, and attains comparatively a large size.

8. **Mytilus hirsutus,** *Lam.*

This bivalve, frequently known as the "Mussel," is found in large quantities, growing together in masses on the rocky shores often left dry by the tides, but also at a considerable depth. When roasted it has much the same flavour as an oyster treated in the same way, and is esteemed by many people. It may be cooked in a variety of ways, as clams are in America.

9. **Anomalocardia trapezia,** *Desh.*

Usually known as "Clams," &c.; this species is quite equal to the well-known clam of America. It is to be regretted that it is not more in use as an article of food in the colonies. Numbers may be taken by trawling over the sandy flats at the mouths of the Hunter and Paramatta rivers, &c., or at low tides by wading among the sea-grass *(Zostera)* nearer the shore.

10. **Tapes undulata,** *Born.*

This species is not often used as an article of food in the colonies, although allied species are usually eaten in other countries. A very small species of an allied genus found at Alexandria is used at Aden and Port Said as a common article of food.

11. **Tridachna elongata,** *Lam.*

This species is common on the reefs on Lord Howe's Island, and is palatable and nutritious. Like the "Clam," it may be cooked in a variety of ways.

12. **Chione calophylla.**

This species is only obtainable by dredging or trawling, unless baited traps be used. While evidence is wanting as to its use as an article of food, being probably not found in sufficient numbers, there is no reason to doubt its usefulness in this way. It was formerly much sought after by conchologists, being a very ornamental species and somewhat rare; lately, however, it has been found comparatively plentiful at the mouth of the Paramatta river and Lane Cove, on a black-mud bottom.

13. **Ostrea virescens,** *Angas.*

It is to be hoped that no naturalist would have the hardihood to break open the shell of so rare a species for the sake of the delicious morsel contained therein. *Ostrea virescens* is only found at very low tides on certain islands in Port Jackson. The specimens have been obtained from Mr. John Brazier, C.M.Z.S., who has also been good enough to furnish the scientific names of the shells mentioned in the foregoing collections, *according to the latest version by conchologists.*

GROUP OF AUSTRALIAN EARED SEALS.

Arctocephalus (Otaria) cinereus, *Péron. Adults, male and female, and young ones.*

There are two, if not three, species of seals still frequenting the New South Wales coast. The largest, called the sea-leopard, *Stenorhynchus leptonyx*, is the rarest, being only occasionally found after severe gales, and then generally in a dead or dying condition. Some of these animals attain the length of from 10 to 14 feet. The skin would make good leather, but it is of no value for its fur, and being so seldom found cannot be looked upon as of any commercial value.

The more common species, *Otaria cinerea*, Péron, which a few years ago was so rapidly becoming extinct that it was found necessary to have them protected by Government, is now happily on the increase, and a fine herd of this beautiful species still inhabits the "Seal Rocks," a little north of Port Stephens. With respect to this species Professor J. W. Clark, of Cambridge, has kindly sent me the following note:—

Otaria cinerea. *Péron.*

"This species was first determined by Péron, whose 'Voyage aux Terres Australes' was published in 1810. He brought home no specimens; but a skull, collected at Port Western by MM. Quoy and Gaimard in 1830, was considered by them to represent Péron's species. This skull is now in the Museum at Paris, and may be regarded as the type of the species. The skull of the male exhibited in the New South Wales Court has been compared with it, and the two are certainly identical. It is the first time that the animal has been seen in England."

An interesting account of the seal fisheries formerly carried on in the Australian colonies will be found in Mr. A. W. Scott's valuable work on seals and whales.

SIRENIA.

Halicore australis. THE DUGONG. *Male and female.*

A fine pair of these curious creatures[*], with oil and lard extracted from their flesh, samples of the skin and hide, and salted meat from the same animals.

The oil is nutritious and in great demand for medicinal as well as culinary purposes, being considered superior to cod-liver oil by many medical men; it is pleasant to the taste, resembling fresh olive-oil, and perfectly colourless when pure, becoming opaque and white with cold below 65° F.

The food of the Dugong consists of sea-grasses, chiefly a species of *Zostera*, which grows luxuriantly on the sandy mud-flats at the mouth and estuaries of rivers, and in the shallow bays along the coast. They are still plentiful all along the north-east coast, and extend their wanderings as far south as Moreton Bay, where at one time they were also plentiful; and they have been occasionally observed as far south as the Tweed and Richmond rivers; but this is now of rare occurrence. The colour of the living animal varies in tints of very light olive-brown above, the belly being of a pale flesh-colour; when dead the colour of the back becomes lighter, the olive tints fading away. Some specimens, notably two

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[*] The animals have been carefully cured and beautifully mounted by Mr. E. Spalding, late of Sydney, now Taxidermist in the Brisbane Museum, Queensland.

(male and female), taken March 1874 at Rockingham Bay, were, when dead, of a uniform dull flesh-colour, and measured respectively 8 and 10 feet; but as a rule the male is the larger.

In its habits, actions, and movements in the water the Dugong closely resembles the Manatus. Some few years ago dugong-fishing was carried on with much energy in Moreton Bay, Wide Bay, and also in the vicinity of Rockhampton, &c., where these grotesque mammals were then abundant. Of late years, however, they have become so scarce that the fisheries have been abandoned, and the species thus saved for a time from being exterminated.

Dr. Hobbs, of Brisbane, who has studied the Dugong from a commercial point of view more closely than any one else in the colonies, was the first to bring the nutritive and medicinal qualities of the oil prominently before the public; his numerous Papers and valuable pamphlets published on the subject at various times, extending over a period of many years, testify to the large amount of labour, skill, and ability expended thereon.

THE
FISHERIES OF SPAIN.

BY

LIEUT.-COL. FRANCISCO GARCIA SOLÁ,

AN EXECUTIVE COMMISSIONER FOR SPAIN TO THE INTERNATIONAL
FISHERIES EXHIBITION.

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CONFERENCE ON THURSDAY, JULY 5, 1883.

LORD EDMOND FITZMAURICE, M.P., in the Chair.

THE FISHERIES OF SPAIN.

After a Paper on the Fisheries of Sweden and Norway had been read, the Chairman said there was still time for another Paper; and as they had on the platform the advantage of the presence of the delegate for the more southern country, he would next ask them to listen to Captain Comerma, who would read a Paper by Lieut-Col. Solá, descriptive of the fisheries of Spain.

The Paper was as follows:—

When the Spanish Commission began to study this Exhibition and everything connected with it, we could not but acknowledge that the Conferences should be the complement of what may be called the struggle of civilisation, because it is not enough to be acquainted with the industry of every nation in all its branches, if you do not, by means of lectures or Papers, illustrate in a wide manner all the details concerning the development of this industry and the ideas prevailing about it in each country.

Acting on this hypothesis we have arranged to give, later on, a Conference,* in which will be reflected the general opinion respecting some important points of controversy, of those of our countrymen who are interested in fisheries. Therefore, the only object we have to-day in addressing this learned meeting is to fulfil a duty of courtesy in answering the invitation which we have had the honour to receive from the Executive Committee.

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* See Paper entitled "Basis for Legislation on Fishery Questions," by Lieut.-Col. Solá, read on 19th July, 1883.

As the time is so short for dealing with so many important subjects, we must confine ourselves to a simple exposition of facts.

The Spanish peninsula has 2,920 kilomètres of coast, which, when considering the fisheries, can be divided into three districts marked by nature by means of slight variations. The first is comprised between the French frontier on the Bidasoa river and Minho limit of Portugal, forming a total length of 1,567 kilomètres of coast. This is the part most productive in fishery industry, and fishing is carried on by some steamers, but chiefly by sailing vessels using nets, lines, and hooks.

The nets used are of many kinds and shapes, having a variety of names, difficult to translate into English; we will, therefore, merely point out that seines, drift and cast nets, with or without bait, and also drag or trawl nets, are used to some extent on the coast we are dealing with.

The most important gear, however, used is the "cerco real" (literally *royal circle*), which is rarely met with, on account of its great cost; it is employed generally for catching migratory fishes, chiefly the sardine (*Clupea sardina*). The fishermen, by means of twenty or thirty boats carrying this net, make a "great circle," and surround a large space of water, joining different parts of it; pulling both ends together, and afterwards drag the whole net towards the shore, forming at last a smaller enclosure. Here the sardines are kept until the preserving factories are able to make use of them, and thus is obviated the neces- of throwing away much useful fish or using it for manure, as happened in former times with the surplus of the daily consumption.

The sardine fishery is one of the most important in Spain, not only on account of the great quantity caught in the present day—about one hundred thousand tons per year—but also by the increasing number of this fish observed near the north coast, and more specially the north-west.

It is in this part of the coast where the greatest trade and exportation takes place, amounting to about an average of sixty-one to sixty-two millions of kilogrammes, of the value of £80,000 to £120,000 sterling. In addition to this, the tinned fish, of which we cannot give an official return; but it may be approximately estimated at the same quantity as the salted and fresh fish.

The number of curing establishments exceeds six hundred.

The culture of oyster and other mollusca, as well as the protection and cultivation of lobsters, is carried on in that part of Spain. There are also many private establishments granted by Government to private individuals for the cultivation of mollusca, chiefly oysters; in consequence of this, and the Government's provision for preventing the depletion, we hope the ancient natural beds—formerly so rich and now nearly all exhausted by over-dredging—will again acquire their former wealth.

The Government is paying every attention to the matter, and is laying down, at the expense of the nation, a model park for oyster culture in order to teach to those interested in the subject the most modern methods for the cultivation of oysters, and so replenish the natural beds, which are now almost completely exhausted by culpable abuses.

This district possesses the most favourable conditions that can be imagined for fisheries, owing, in the first place, to the unevenness of the bottom of the sea—with an exception in the case of the estuaries, drag-nets cannot be used—and secondly on account of the geographical position, formed by a line from east to west, where the very many estuaries and small rivers deposit great abundance of food for fish from the fertile lands they run through. As the inland estuaries are also favourable to the increase of fish, there may be said to be many good elements given by nature to that privileged coast.

The second district or division begins at the mouth of the Guadiana river and ends at Gibraltar, being in all 204 kilomètres. In proportion to its length it is no less rich in fish than the former, and a proof of this is that, very few years since, those shores were nearly uninhabited, and now there has been formed there a colony of fishermen in Cristina Island with a considerable population.

There are found excellent waters, large creeks, good bottoms, and temperate climate. The prevailing mode of fishing is with nets and some lines; the most important of the former being the *galleons*. Now, unfortunately, they commence to use the drag-net, called "*bou*," a model of which can be seen in the Spanish Court of this Exhibition. The *almadraba*, also shown in our section, is a fixed net for the tunny and other species coming every year from the Atlantic to the Mediterranean Sea through the Strait of Gibraltar.

Some enterprising foreigners, encouraged by the abusive capture of oysters which is allowed to take place in Portugal, and by the high prices at which these molluscs are valued on account of their large size, easy production, and superior alimentary conditions attributed to them, intended to utilise the natural beds, and so drag them, heedless of wasteful destruction; but the Government has taken notice of it, and will not permit any establishments beyond those applied to the production of this favourite mollusc.

All the salted and pickled fish of Cristina Island and those taken with the *almadraba* are for the most part consumed in Spain, but a small quantity is exported. The proximity of the salt-pits of San Fernando afford great advantages to the fishing industries of that part of the country.

Sailing vessels and some steamers are used for fishing purposes.

The Mediterranean shores from Gibraltar to the eastern coast of France, a length of 1,143 kilomètres, form the third district alluded to. It is the poorest in fish, considering its great extent, and the drag-nets are employed there on a larger scale than in the other divisions. The reason of this scarcity is to be found in the destructive nature of the kind of apparatus used, because the natural conditions for the propagation of fish cannot be better. The supply of food for fish, due to the considerable quantity of vegetable and animal substances carried to the sea along the different rivers, through most fertile land; the good temperature in that part of the country, and the abundant submarine vegetation, show that the scantiness of fish can only be attributed to over-fishing.

So many and different are the gear, nets, &c., employed for fishing on the east and south coast of the Mediterranean that it would be almost impossible, or at least would require a great deal of time, to describe them.

The nets are used generally without bait, which is only adopted for hooks. As an element of attracting fish, torches and lights are employed for fishing with spear and nets.

A new invention, or rather an improvement has been exhibited by a fisherman of Tarragona; it is intended for fishing with a light, and consists of a boat fitted with four petroleum lamps in a glass case fixed at the bottom of the boat with a reflector behind them, in order to concentrate the beams of light and throw them downwards into the water. Knowing the inclination of the fish to follow the light, it cannot be denied that this apparatus will give satisfactory results, and this has been already practically proved since the appearance of this invention, as by it a larger amount of fish has been caught than by any other apparatus formerly known.

The nets used with the submarine light boat are called *almadrabilla*, and are cast by three boats, forming underneath, when the fish commence to follow the light, a kind of purse, in which the fish become imprisoned.

It can be easily understood that their principal advantage over the other systems of fishing with light consists of the means of throwing light to a greater depth, and covering a larger area.

It has occurred to us that when the electric light can be obtained cheaper, and with accumulators or batteries, as the nets used are of a kind not injurious to the fish, the advantages will be further increased.

It must be remarked, that near the shores of the Mediterranean are some inland seas called *albuferas;* the principal one is the Mar Menor, and afterwards, those of the Delta of the Ebro river. In these saltwater lakes are some fishing establishments which promise in the future better results in sea-fish culture than those of the well-known lake of Commacchio, near the Adriatic.

Many grounds with coral may also be counted along that coast; but some want to be left at rest for ıe time for reproduction, as they are at present exhausted with the immoderate use of the diving apparatus.

The inhabitants of the Calabrian shore, who have for many centuries been devoted to coral fishing, are now subject to a complete paralysation on account of the increased duties charged to them on the northern coast of Africa; a similar falling-off has also occurred in Cabo Verde Islands.

It is urgently necessary that nations possessing coral grounds should pay more attention to the gradual reproduction of these and other useful zoophytes, giving to them more time for growing, and should also take much care and exert great vigilance about the extraction; and they will in this way avoid the extirpation of the roots, as the coral-fishing divers do in using their axes—as this is an abuse that makes many consider the use of diving apparatus injurious, although it may be, indeed, an improvement in this industry, because the projecting arms of other coral fishing apparatus can never go through all the sinuosities of the caverns, nor can they easily cut the branches found in some hollow parts of the upper parts.

As regards the manufacture of fishing material, we may say that it takes place along all the coast of Spain; the vessels and hooks, of galvanised iron, are built and made in the Basque and Catalonian provinces, and our nets are made by machinery in the factories of Catalonia and Mallorca.

In conclusion, the administration of the sea fisheries is in charge of the Minister of Marine, under whose authority works a Central Fisheries Commission, composed of men eminent in all branches of science and industry; in each maritime province there exists another board, composed of the harbour master, a lawyer, a naturalist, and some ship-owners, or manufacturers connected with fishing industries; all these corporations are devoted to practical observations and experiments, in order to get all the practical information about fisheries.

The Central Commission reports to the Government all the subjects under their consideration, proposes the improvements that they may think convenient with a view to making laws and regulations, and spread knowledge of fisheries and encourage manufacturers by the publication of their works.

The fishing industries of Spain being represented at the Fisheries Exhibition in London by the Commissioners, under the Chairmanship of the President of the Central Commission in Madrid, we will now take the opportunity of giving our most hearty thanks to the Executive Committee of this Exhibition, at the head of which is an illustrious Prince, for all the kindness and attention we have received from them, and also for the instruction we have acquired, showing us the progress of all the nations here present, to the Commissioners of which we also address our congratulations.

The CHAIRMAN, having alluded to the interesting character of the Paper just read, said there were several other delegates prepared with Papers. It would be far better, instead of trying to hurry through them, for the meeting to be adjourned, and hear these Papers on a future occasion.

Mr. DUFF, M.P., then proposed a vote of thanks to Lord Edmond Fitzmaurice for presiding. They could all easily imagine that at the Foreign Office his noble friend found considerable occupation, and in addition to that he could personal knowledge, that he was often required and always responded to the appeal made to him to attend in his place in the House of Commons. Considering, therefore, the great demands made on his time, they were much indebted to him for coming to take the chair that day. He would only further add that, whether his advice with regard to fish diet were taken or not, he was quite certain that those troublesome questions which sometimes came before him connected with fishery matters in foreign countries would always receive from him an impartial and judicial treatment.

Mr. MONDEHARE said he was desired by M. Mancel, the French Commissioner, who did not feel himself sufficiently conversant with the English language to do so, to second most cordially this vote of thanks; and he begged him to avail himself of the opportunity to express how grateful the French sailors and fishermen who visited the Exhibition had been to the English people for the hospitality they had received.

The motion having been carried unanimously—

The CHAIRMAN said it was not only a great pleasure to be present that day, but he also felt it to be his duty to attend, because he appeared in a humble way as representing the Foreign Office, and to extend to the foreign delegates that welcome which he could assure them was most cordially extended to them by his noble chief, Lord Granville, who would have been present had it been possible. In conclusion, he begged to move a most hearty vote of thanks to the gentleman whose Paper had been read.

THE
FISHERIES OF THE BAHAMAS.

BY

AUGUSTUS J. ADDERLEY,

COMMISSIONER FOR THE BAHAMAS TO THE INTERNATIONAL
FISHERIES EXHIBITION OF 1883.

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THE

FISHERIES OF THE BAHAMAS.

HER MAJESTY'S possessions, the Bahama Islands, extend from the northern coast of St. Domingo to the eastern coast of Florida, United States, a distance of nearly 600 miles. In all there are 29 islands, 661 cays, and 2,387 rocks. The area is 4,424 square miles.

The population by the census of 1881 was 44,000. Of this number about 10,000 are whites, the remainder descendants of emancipated Africans. The population per square mile is about 10.

The principal islands are New Providence, on which is the capital Nassau, Grand Bahama, Eleuthera, Andros, Abaco, Long Island, San Salvador, Rum Cay, Inagua, Crooked Island, and Berry Island. The formation of the islands is of calcareous rocks, of coral and shell, hardened into limestone, and much honeycombed. There are no traces of primitive or volcanic rock. The shores generally rise gradually to a hill range in the principal islands, perhaps to a height of 250 ft. With the exception of the island of Andros, no freshwater rivers exist. The supply of water is from wells and from rain-water tanks.

The woods are the mahogany, lignum vitæ, iron, mastic ebony (green and black), braziletto, logwood, satin wood, and many others. A wood called horseflesh is in great repute for ship's timbers, being hard and practically everlasting. In former times the wooden walls of old England were partly formed by timbers cut from Andros. The fruits are oranges, lemons, limes, pineapples, bananas, plantains, melons, yams, potatoes, tomatoes, sugar cane, ginger, cocoanut, and many others. There is a large export of pineapples, oranges, and tomatoes. Tobacco and cotton grow readily, but labour and perseverance has so far been wanting to develop these important products. The castor-oil plant grows wild, and the cascarilla and canella alba barks are exported to a considerable extent.

Animal life is restricted to the wild cat, raccoon, and guano; whilst a dog that did not bark is said to have existed among the aborigines.

Of birds, flamingoes, wild ducks, pigeons, are plentiful. There are also parrots, geese, humming birds, cranes, snipe, &c.

Of fish the varieties are innumerable. Some of them by their local names are as follows: Grouper, Red Snapper, Market-fish, Barracouta, Hound-fish, Porgy, Goggle eye, Jack, Mutton-fish, Shark, Stingray, Mullet, Cray-fish, Sword-fish, Bone-fish, Hog-fish, Turtle, Angel-fish, June or Jew-fish, Dolphin, King-fish, Grunts, &c.

The fishing-boats, numbering 100, and employing 500 men, are usually of the sloop rig, with a leg-of-mutton sail, and a well for keeping the fish alive. The sponging and wrecking vessels, numbering 500, are of schooner rig, fine models, and fast sailers. They are built by the islanders, the timbers being of native hardwood (horse-flesh), the planking of yellow pine, from North Carolina, and vary in tonnage from 15 to 60 tons.

Fish are caught with fish-pots, hand-lines, and nets, the nets being taken out some distance from the land, and hauled slowly in to the shore, when a great variety, many of brilliant and variegated colours, is usually secured. It forms an important article of food, but none are exported, with the exception of turtle (*Chelonia Mydas*) and the hawksbill (*Chelonia imbricata*), yielding the tortoiseshell of commerce.

The bait used in line-fishing is usually the conch. The fish are drummed up by striking two shells of the conch together, and are ground-baited as in English rivers. During the boisterous north-west winds, prevailing between November and February, they are difficult to catch, and are brought alive in the wells of the boats, and thus sold in the market-place.

The estimated value of fish used in home consumption is £18,000 per annum, and of turtle exported, £600 per annum.

King, queen, and common conch-shells are exported in large quantities, being used for cameos, and in the latter is found the beautiful pale pink pearl now becoming so valued. The value of shells exported is £1,200 per annum, and of pearls £3,000 per annum.

Ambergris is also found on these shores, and sea-cucumber (trepang). The value of ambergris exported is £1,000 per annum.

Corals and small shells, which are very beautiful, are largely collected, and find a ready sale among the American visitors, and in England.

The value of the sponge exports for 1883 is estimated at £60,000. In 1882 it was £59,033. The sponge trade gives employment to several thousands of persons and some hundreds of vessels, the sponges being divided into coarse and fine. The principal varieties, in the order of their value, are known as sheep-wool, white reef, abaco velvet, dark reef boat, hardhead, grass, yellow, and glove; and of some of these varieties there are several grades, designated by numbers, all being used for mechanical, surgical, and bathing purposes. Bahama and Florida sponges are about equal in texture and value, but both are inferior to those of the Mediterranean. The vessels employed in sponging are small, with crews of from six to twelve men. About six weeks' provisions are taken on board, and they then coast along the banks and reefs, where the water is shallow and generally so clear that the sponges are readily seen, and are brought to the surface by hooked poles, or sometimes by diving. When first brought up they are covered with a soft gelatinous substance as black as tar, and full of organic life, the sponge as we know being only the skeleton of the organism. The day's catch is spread out on the deck so as to kill the mass of animal life, which in dying emits a most unpleasant smell. Then the spongers go ashore and build a pen or "crawl" of stakes close to the water's edge, so that the action of the tide may wash away the black covering, in which it is aided by pounding the sponges with sticks. When this operation is completed, the sponges are strung upon small palmetto strips, three or four to a strip, which is called "a bead," when they are taken to Nassau to be sold in the sponge-market under certain conditions and regulations, nobody being allowed to sell his cargo otherwise than through this sponge exchange. On the conclusion of the sale the sponges are taken to the packing-yard, where they are sorted, clipped, soaked in tubs of lime-water, and spread out to dry in the sun. They are then pressed by machinery into bales, containing 100 lbs., and in this state are shipped to England or the United States, which of late years is most the largest customer for Bahama sponges. The export has been gradually increasing, for whereas in 1874 it only represented £16,000, in 1881 it amounted to £31,000, and the year before to £35,000. A new sponge-field was discovered last year at the Island of Eleuthera, 60 miles from Nassau, extending over an area of many miles, and yielding the sheep-wool, the most valuable quality. Notwithstanding this fact, there have been two drawbacks to working this field, one being, though the sponges are of a very large size, they are exceedingly tender in the inner portions, and will not cut to advantage; the other, that at certain times of the year myriads of small fish, known as "sailors," arrive at the field and stir up the muddy bottom to such an extent that not a single sponge can be seen.

The sheep-wool sponge brings quite as high a price in markets as the Turkish variety of same. The success which is said to have been attained in the artificial propagation of the sponge by Professor Oscar Schmidt, of the University of Gratz, may lead to great development of this industry in the Bahamas. To the late Sir John Lees, father of the present popular Governor, the people owe a debt of gratitude for the discovery of the sponge.

Salt is made in large quantities by solar evaporation, and is much esteemed in America for packing purposes for pork and beef.

In consequence of the number of islands, harbours are easily made during heavy weather, and sad cases of distress are of rare occurrence.

Several friendly societies exist for mutual aid in time of sickness.

Mr. R. Davey, in his agreeable account of a visit paid to the Bahamas in 1878, thus describes his first impression of Nassau:—

"Nassau, the capital of New Providence, is considered a rival to Nice as a sanitarium and winter resort. In many ways it is indeed a superior residence, for the climate is milder and much more equable. During my winter stay, the thermometer never rose above 81° or descended below 70°. There was scarcely a breath of wind, and rain fell abundantly in the night, but never in the day-time.

"It is now decided by the leading medical authorities in America, that in no part of the known world is there another climate so beneficial to persons suffering from nervous diseases. Rest of brain and muscle, body and mind, becomes almost inevitable in the delicious balmy atmosphere of Nassau. You insensibly give way to the prevailing *dolce far niente* of the place, and there is absolutely no great excitement, social, political, or artistic, to stimulate you. There is society, plenty of it, for the hotels are often crowded to excess by persons of wealth and fashion, but after eleven o'clock all have retired to rest, and the whirl of balls and other like dissipation, is, although by no means unknown in the fair 'Isle of June,' as the natives love to call their charming island, of a less exciting kind than in most other fashionable resorts.

"It was early on a bright winter morning that our good steamer *San Jacinto* passed into the harbour of the capital of New Providence. As I leaned over the deck and looked down into the waters upon which I was sailing, I could scarcely believe my sight. It seemed impossible that water deep enough to bear our vessel should be so marvellously clear. We appeared to be passing over a sheet of pale sea-green crystal. Not a pebble, bit of sponge, shell, fish, crab, or coral, but was distinctly visible as if only a few feet under the surface. It was like floating upon ether, for the sparkle of the sunlight alone persuaded it was water. No, there was something else, for as we neared the wharf, a score or so of dusky forms splashed into the briny mirror, broke up its rippleless surface, sent into the air a spray of diamonds, and then dived far down into its pellucid depths in quest of coppers liberally thrown them by the amused passengers. 'Please, boss, give us a small dive,' is the entreaty which greets you from a dozen little black urchins, who, on the least encouragement, jerk off their coats and shirts and plunge into the sea. Sometimes they catch the coin before it touches the bottom; at others, however, the diver remains quite a time searching for it, looking, as seen from above, with his wriggling legs and arms, for all the world like a huge black spider."

When, on October 17, 1492, Christopher Columbus landed on the shores of "Guanahai," and named the present island of New Providence San Salvador, he was so enchanted with its beauty that he wrote a letter to the Spanish sovereigns, in which he expressed his delight and enthusiasm. "The loveliness," says he, "of this island is like unto that of the Campana de Cordoba. The trees are all covered with ever-verdant foliage, and perpetually laden with either flowers or fruit. The plants in the ground are full of blossoms. The breezes are like those of April in Castille. The nightingales (mocking-birds?) sing more sweetly than I can describe. It seems to me that I could never quit so enchanting a spot, as if a thousand tongues would fail to describe it, as if my hands, spell-bound, would never be able to write concerning it." Due allowance being made for the nervous enthusiasm of an explorer inebriated with the treasure he has found, it must still be confessed that his words, all-glowing as they are, scarcely exaggerate the charms of the peaceful scenery which so inflamed his poetic ardour, for the Bahamas are islands like unto the one chosen by Shakespeare for the scene of the 'Tempest':—

"Full of infinite delight."

Surgeon-Major Bacot, in his interesting work 'The Bahamas,' published in 1869 by Messrs. Longman and Co., gives a great deal of curious information concerning the by no means unromantic history of the islands. He speaks with horror of the cruelties inflicted upon the wretched aborigines by the Spaniards, and of the enormous oppression which they endured, an oppression so excessive that it met with the stern condemnation of the human and illustrious Dominican Los Casas.

The transfer of the islands from Spain to England, at the cost of many a bloody episode, forms a lengthy and exciting period in colonial history, one, however, far too pregnant with startling events to be dwelt upon in these pages. The piratical history of the islands is also of deep and picturesque interest, but, although it abounds in romantic incidents, I must perforce pass it by and merely allude to it by saying that the novelist and the lover of exciting narratives will find in the pages of 'The Memoirs of Peter Henry Bruce,' of 'Daniel McKinnen's Tour of the West Indies,' and of 'Montgomery Martin,' enough material for more than one exciting story of old colonial life.

The object, however, of this Pamphlet is not historical, but essentially practical, and, moreover, devoted principally to the fisheries and fishing industries of a colony, which by reason of its superb climate and its proximity to the United States, is of very great value to the Crown, and the inhabitants of which are essentially loyal and earnest in their endeavours to progress with the rest of the world in intellectual and commercial prosperity.

The island of New Providence is about twenty miles long by seven in breadth, and is the most important, though by no means the biggest, of the Bahama group. The history of the island since its discovery by Columbus, down through the buccaneer period, is only interesting its inhabitants and government. I may observe that, however unpleasant may be its memories of the old pirate days, it is a remarkably respectable place, not even a murder having thrown a shadow on its nearly untarnished reputation during the past fifteen years. It would be difficult to imagine a quieter spot. On Sundays especially, is it quiet, when not only are the shops all closed, but the majority of the house-shutters also, and the tranquil air is laden with church music of the most orthodoxly sober description.

The first place you drive to on landing is *the* hotel—the "Royal Victoria." This homelike and admirably organised house can accommodate at least 300 persons. The rooms are very clean and pleasant, and the board abundant and varied. The charge per day is only $3 (12*s.*), everything included, except, of course, wine and spirits. The "Royal Victoria" stands in a beautiful tropical garden, and, as it is a picturesque building, produces a most favourable effect, especially upon those who have just landed from New York, which, perhaps, they left only four days previous, in the midst of a snow-storm.

"The first impression," continues Mr. Davey, "produced upon our arrival in Nassau, from Cuba, was rather singular, and concerned the marked difference of the influence of the Spanish and the Anglo-Saxon races upon the African. Cuba is a Spanish colony, and unhappily (although the cursed institution is slowly dying out) still a slave country, with a large coloured population; New Providence has a population of 15,000 free negroes to only 4,000 whites. Personal observation only can give any idea of the filthiness of the dwellings of the lower classes of Cubans, and especially of those belonging to the blacks. The coloured folks of Nassau are cleanly and tidy to a great degree. Most of the Cuban towns are more or less squalid. The city of Nassau is, if anything, too prim, and its inhabitants are models of order in their dress and habits. I saw at a glance that the coloured people here have been disciplined and trained by a race which is certainly as superior to the Spanish in all that concerns common-placedness and common sense, as it is inferior in its natural artistic instincts. I never saw anything, no not even in the Bethnal Green district of London, to surpass the interiors of the Cuban cottages in unutterable disorder and general abomination. But as you pass along the roads at Nassau, and glance in at the windows of the negroes' cottages you will almost invariably perceive interiors worthy of the brush of a Teniers or of a Sir David Wilkie, a floor on which you could eat your dinner, neatly papered walls, with framed chromos symmetrically arranged upon them, spotless curtains, shining brass lamps and cooking utensils, and a bed covered with a counterpane as white as drifted snow. If you peep in at meal times, you will note a clean cloth, covered with orderly-arranged plates and dishes. I am speaking of the dwellings of negroes, of those self-same coloured people, who in the same climate, only a day and a half's journey away in Cuba, under another race and civilization, dwell in a condition too nasty to be described here."

I cannot forbear here introducing an exceptionally vivid description by Mr. Davey of the town of Nassau and of its population, which I shall also supplement with this popular writer's remarkable word-picture of the "sea garden," which has been so frequently quoted on account of its graphic picturesqueness.

"As you drive," I said, "through Grant's Town, the negro quarter, you see so much to gladden you that it must do more real good to an invalid than many a cunningly-prepared draught. Charmingly picturesque wooden huts, thatched with palmetto, and as neat as you please, overshadowed by cocoa-nut trees, and exquisite flowering creepers border either side of the road, and on their thresholds are laughing groups of women and children of every shade of black, mahogany, and 'yullah.' Then, when the shades of evening grow long and deep in the thickets of the banyan-trees, coloured Pyramus courts coloured Thisbe over the wall which separates their gardens, and the roads are literally swarming with little darkies, romping, laughing, and chasing each other round and about, whilst neatly-dressed women, standing at their doors, or leaning out of their open windows, watch the return of their ' men,' as they boldly call their husbands. The air is still, and laden with the penetrating perfume of the Cape jasmine, the white blossoms of which gleam like stars amidst the dark foliage, and of the crimson and pink oleander which flowers here to great perfection. No pen can describe or give even a faint idea of the delicious peacefulness of the scene, of the cheerful sounds of greeting, of the merry clatter of the negroes, the tuning of banjoes, and above all, of the beautiful sunset-lit clouds above, which shed a rosy tint abroad, and mark in bold relief the tall stems of the waving palms, and of the strange-named but useful trees, whose bizarre foliage so attracts attention, and between whose gnarled boughs you catch glimpses of the high-roofed houses of the city, of the cathedral spire, and of a sea as blue as a turquoise, now shivering in the gentlest of breezes.

" The town of Nassau itself is not particularly interesting, inasmuch that, with the sole exception of the cathedral, it cannot boast of a single monument of any artistic importance. The houses are mostly built of stone faced with wood, and possessed of high-slated roofs and wide verandahs, which surround each story and afford cool shade during the sunny hours of the day. The public buildings are clean and unpretentious, and evidently modelled after those of some English village in which the sturdy and inelegant Georgian architecture predominates. There are few traces anywhere of the influence of the higher art, although the cathedral itself is an exceedingly handsome Gothic building, wherein the services of the Church of England are most admirably conducted.

"The gardens are trim and pretty, but, notwithstanding their profusion of tropical plants, lack the luxuriant charm which makes the ill-kept garden of Havana so romantic and picturesque. Very few of the private houses are of superior size, and even the Governor's palace is a modest-looking dwelling, situated on the highest of the surrounding hills, and commanding a fine view of the town and harbour.

"The chief monument of Nassau is not one built by hand, but a silk cotton tree, planted some two hundred years ago by John Miller, Esq., opposite where now stands the 'public buildings.' It is a stupendous tree of Titanic proportions. The roots, unable to find their way down through the rocky soil, swell up like great buttresses, radiating round the trunk some fifteen yards, and rising from the ground six and eight feet, making a part of the actual bulk of the tree, and giving the huge plant the appearance of a web-footed monster, standing in solemn reverie. Among these gnarled and weird roots are ravines, in whose dark hollows a legion of elves could dwell and hold their revels. High above this root-works spreads a canopy of leaves of the most exquisite, tender green. Singular to say, the gigantic plant flattens its branches at the top, nearly squared off in correspondence with the flatness its roots are obliged to assume owing to the paucity of earth. Had Shakespeare seen this august tree, which travellers from California declare to be even more imposing than any of the Mammoth trees, he would have immortalized it in a few grand lines. Or, perhaps, made it the background of some quaint fairy scene, or the home of another Herne the Hunter, Oberon and Titania, Ariel or Puck. There are several other fine silk-cotton-trees on the island, and in Cuba this tree grows to perfection; but *the* tree I have first attempted to describe is universally acknowledged to be the finest known. I was much surprised to notice the rapidity with which this plant puts forth its leaves. On my arrival, I saw one of the trees in the grounds of the hotel, which seemed to be dead. The rest were in leaf, but this one was quite barren. In three days it was lost to sight, hidden in its own new foliage, put on in at most two nights. The silk-cotton-tree is so called because it bears a pod full of flossy silk, which is used for filling pillows instead of down, but they say the fibre is too short to be woven.

"Nassau and its neighbourhood is really not unlike an open-air museum of botanical and marine curiosities. As you drive or walk through the woods and lanes your attention is constantly attracted to some tree or shrub peculiar for its curious shape, leaves and flowers. If you ask its name you will be told that it is either the gum-arabic-tree, the guava, the banyan, or the ipicac, or the pimento, or the spice, the cinnamon, the pepper, the caper, the castor-oil, or in short any one of half the plants which stock our drug or grocery shops. One day I noticed an onion-like looking plant, with somewhat curious leaves, and asked its name. It turned out to be my old acquaintance 'squills,' of syrup fame.

"The crowning glory of Nassau is her unrivalled bay, with its enchantingly crystal clear water. Many a pleasant day have I passed sailing round the pretty shores of this pleasant island. We usually had for 'captain' a certain remarkable darkie, by name 'Captain' Sampson Stump, one of those sable worthies you read about, full of devilry, and withal shrewd and witty, and a capital sailor. The Cap'en is reputed wealthy, for he is a great favourite with the visitors, and on Sundays he is considered by the inhabitants of Grant Town the greatest 'dissentin' minister' in the island. Amongst the natural wonders the Cap'en took us to see was the 'sea garden.' I wish Victor Hugo could behold it, for then he could paint in his vivid language a pendant to his sea monster, the devil-fish of the 'Toilers of the Sea'; but this time he would show us the beautiful instead of the hideous—the paradise of the sea, and not its hell. They give you a box with a glass bottom to it to look through, which you put over the side of the boat and dip beneath the surface of the waves. Lo! you behold the garden of the sea-nymphs, the home of Aphrodite. Beneath you, seen through the pale, pellucid waters of this vast aquarium, is a lovely garden, full of every imaginable delicate-tinted sea-flora. Some are pale pink, others are of light yellow, and some brown as leaves in autumn, surrounding the vivid purple and scarlet sea anemones, which cling to the summits of beds of pearly coral. Here purple sea-fans wave gently to and fro. Here are groves of wonderful sponges, and here beds of marine flowers of all kinds and shapes. Fish as brilliant as humming-birds—red, blue, and metallic green and orange—peep in and out knowingly of the branches of this strange submarine vegetation, which is crossed and re-crossed in all directions by pathways of the soft and silver gravel. Nothing more fascinating, more fairylike, can be well imagined. We expect at any moment to see Venus or one of her nymphs rise to the surface from this abode of cool delights; but more frequently the clear aquamarine-coloured waters part and close, bubbling over the dusky form of a sturdy negro diver in search of pink conch-shells or stag's-horn corals for some *belle* from England or the States, whose pretty exclamations of surprise and delight, 'Oh, see!' and 'Oh, my!' sound cheerily enough on the summer air.

" Involuntarily the world-renowned description of the bottom of the sea was brought to my mind:—

> " Methought I saw . . .
> Wedges of gold, great anchors, heaps of pearl,
> Inestimable stones, unvalu'd jewels,
> All scatter'd in the bottom of the sea.
> Some lay in dead men's skulls; and, in those holes
> Where eyes did once inhabit, there were crept
> (As 'twere in scorn of eyes) reflecting gems,
> That woo'd the slimy bottom of the deep,
> And mock'd the dead bones that lay scatter'd by."
> *Clarence's Dream, Richard III.*

A very extraordinary fact about the vegetation in the Bahamas is, that it grows with its roots almost entirely exposed. The island is of coral formation, and only very lightly coated with earth, but such is the abundance of the dews and the fertilizing quality of the atmosphere, that it suffices for a plant to have but one or two feelers caught in the pores of the coraline rock, as it is called, for it to grow and flourish. I have seen big trees with all their roots, save one, above ground. Some trees I have noticed growing on the garden wall, horseback fashion, with one half of their roots on one side and the rest on the other. I am assured that there is so much decayed animal matter in the coraline that it is one of the richest of soils; and the cause of the fertility of the island is doubtless the heavy dews which fall immediately after sunset. A number of " air-plants " grow in the woods, and course derive their nourishment entirely from the abundant dews. These curious plants are, for the most part, a species of wild pine, and although found suspended to the branches of trees, and apparently existing without any other nourishment than air, they are really fed, as I have said, by the heavy moistures of the night. One of the most remarkable of them is the green snake, which looks exactly like a long serpent made of coloured india-rubber. It lays on the branches of the trees, but requires no earth, and subsists on dew. The common life-plant of the tropics grows everywhere, and, together with the air-plants, affords much curiosity to visitors from Europe and America. If you take one of its thick, waxy, oak leaf-shaped leaves and hang it on a nail, it will live for months and shoot forth new leaves without needing either water or earth.

The maladies of all others which Nassau benefits most are those of the lungs and nervous system, and this I am assured is now the opinion of the leading medical men in New York. For the advantage of such of my readers who might perhaps wish to visit this charming resort, I quote the following valuable remarks from the New York 'Medical Record,' February, 1877:—

"The drinking water of Nassau is of two kinds—that from reservoirs, being stored rain-water collected from the roofs of houses; and that from wells. The former only is generally used by the well-to-do white population, exclusively so at the hotel, and is an unusually good potable water.

* * * * * * *

"The surface drainage of the city is excellent. Water soon disappears, either through the gutters cut in the stone—which, by the way, are very good—at the roadside, or by percolation. It would hardly be possible to find a stagnant pool of any kind. The streets are very neat, and as both the narrow side-walks and the carriage-ways are cut on the native rock, and are equally hard and clean, it is more customary to walk on the latter than the former. All the roads throughout the island are of the same character, constructed by the government, and kept in repair by convict labour. There is no dust.

"The mean temperature during the winter months is somewhat higher than at other health resorts, as is shown by the following comparisons:

Place.	Nov.	Dec.	Jan.	Feb.	March.	April.
Nassau, N.P.	76·8	73·6	73·6	73·7	75·4	76·1
Savannah, Ga.	58·6	51·5	52·2	54·5	60·4	67·7
Jacksonville, Fla.	64·1	54·2	56·4	56·1	64·2	67·8
St. Augustine, Fla.	64·1	57·2	57·0	59·9	63·3	68·8
Pilatka, Fla.	61·5	56·0	57·2	58·3	64·1	71·2
San Diego, Cal.	56·9	51·7	51·9	53·3	56·0	61·2

"But the average mean temperature of a month may be quite deceptive. It is the diurnal and from day to day fluctuations which are of the greatest importance and have the most influence upon the health of invalids. In this particular Nassau has an advantage over any locality on the Atlantic side of the continent.

"No other place we know of so well fulfils the requirements of a winter sanitarium in this respect as Nassau.

* * * * * * *

"The Royal Victoria Hotel is perhaps superior to any in the south in its hygienic appointments, and is equalled by few anywhere. Its table is supplied with excellent food, well prepared.

"To briefly recapitulate: From November to April, Nassau has a warm and remarkably equable climate.

"It has a moderate degree of humidity.

"Its surface is well covered with vegetation.

"Its drainage, chiefly by subsidence into the rock, is good.

"Its stored drinking water is ample in supply, and healthful.

"It is quite free from malarious and other endemic diseases."

* * * * * *

The fisherman's calling is ever an anxious and an arduous one, and in the Bahamas, the maritime population is subjected to great physical exertion, and prolonged absence from home. I am given to understand, the vessels in which they ship are poorly fitted and overmanned; if this is the case, legislation should remedy the evil. Life-preserving apparatus should be made an absolute necessity in an outfit, and heavy penalty incurred through any default.

The marine products of the Bahamas are undoubtedly susceptible of very important expansion, and I make the following practical suggestions to that end:—

On the subject of the Sponge Fisheries, I have fortified my opinion by the important Paper herewith attached, written by Mr. Saville Kent, F.L.S., F.Z.S., an authority on this special subject. I am of opinion that a close season for sponges would not be practical or beneficial, the most favourable, if not exclusive season for their collection being the summer months, which is likewise the time during which they usually reproduce their species.

On the other hand, a very great advantage would be derived from the periodical isolation and protection of suitable areas upon the sponge grounds, to enable them to recover from the effects of over-fishing; or to form as it were a nursery from whence the sponge germs would be freely distributed throughout the surrounding districts.

I suggest experiments with the object of introducing into your waters the fine concave, or cup-like form of sponge (*Spongia officinalis*) of the East, provided it is not already there, as suspected by Mr. Kent in his Paper. The prohibition of the dredger in shallow waters should be continued.

I am of opinion that vessels of from 40 to 50 tons burden, with diving apparatus for men, to enable the careful collecting of the sponges, are best for this class of fisheries. By using the diving dresses, fishermen would only disturb those sponges which are matured, and the present primitive mode of hooking, so injurious to health, would cease. The expense of the dresses would be soon defrayed by the more expeditious collecting, the saving of labour, and also by the more presentable and merchantable state of the article when brought to market, in addition by searching in the same depth of water, as in the Mediterranean, instead of in the shallow waters as is the custom, finer qualities of sponges would undoubtedly be found.

I would also advise a close season for the Queen and Pink Conch; but I fear it is not practicable. I am under the impression that this fish is not so plentiful as it used to be, and that its protection is desirable. I think these two varieties of mollusks may be made a source of considerable revenue. The shells are, I believe, found only in the Bahamas, and a limit being placed on their export, as has been found necessary to do with corals in Japan, would lead to a considerable increase in their value. Combination among the exporters would have the same result. They are used to an immense and increasing extent in Italy; and in the case of the pink shell, sold in this country at a shilling a-piece, I am quite sure from the offers I have had for those in the Exhibition, that twenty times that amount would be readily paid, if the price were firmly maintained, as the profit when converted into cameos and other *objets d'art* is enormous.

I shall refer again to this matter in another part of my Paper.

On the subject of fish-curing, I think that if the goggle-eyes were cured by the same process, and with equal care as the herring in this country, and the jack, as the mackerel in Newfoundland, a market would be found not only in Europe, but also in the Catholic parts of Southern America.

Such a harvest of the sea should not go ungarnered, and the Red Snapper and Grouper should be exported in tins. There is already a demand for these two fishes in America. The United States alone, after its own consumption, exports of fish in tins six hundred thousand pounds (£600,000) in value annually.

Among waste products I suggest the skins and bones of fishes being utilized for the manufacture of glue and isinglass in the colony itself. On this subject, Professor G. Browne Goode says in his Paper on the fisheries industries of the United States :

> "The utilization of secondary products of certain fisheries by adding in an appreciable degree to the profits of each person engaged, has proved an important impetus. Mr. Earll has demonstrated that the secondary products in the cod fisheries amount to more than 14½ per cent. of the value of the fish as taken from the water, raising the receipts of several important ports by about one hundred thousand dollars (100,000) each."

Dried Green Turtle and other preparations of Turtle from Jamaica which I introduced to the notice of a number of experienced gentlemen at a special luncheon which I gave for the purpose, were pronounced so excellent that it was even asserted that these preparations were far better and richer flavoured than any to be procured in England, made from fish brought alive to this country. As the same Turtle is to be obtained in the neighbouring waters, there is no reason why its preparation in various ways should not be added to the other industries of the Bahamas.

The *Bêche de mer* from these islands is, I am given to understand, well prepared, and of the kind most esteemed by the Chinese. I think arrangements might be made with American railway companies for a through rate of freight to San Francisco, with a view to leaving a fair margin of profit to the shippers. The Chinese there would make a market, and perhaps among Europeans it might become popular, for many in travelling in the East have learned to esteem it.

During the course of the Exhibition, the Nassau shell-work ornaments might have been sold in immense quantities. They are superior in workmanship and beauty of design to anything made elsewhere, and a depôt at the West End of London would certainly pay well. Her Royal Highness the Princess of Wales did the colony a distinguished honour by accepting a shell basket, sent on by the Government, and personally expressed to me in kindly words her great admiration of it.

Tortoise-shell ornaments will sell readily, but if they cannot be produced at a lower price than those sent on, say about one-third, the sale must be limited to the colony. No doubt this can be remedied by using better tools. The establishment of a local school of art would greatly facilitate this, and moreover introduce the art of inlaying the shell with silver and gold, as is so satisfactorily done at Naples.

The great success which has attended the creation of Art Schools in France, Italy, Bavaria, and Saxony, has been such as to deserve the attention of all thinking people It is certain that the South Kensington Museum and School of Art has been of vast benefit to England, and indirectly also, by contributing to the improvement of artistic taste in America and the Colonies. But the time has come when local schools of art especially created for the immediate development of their natural products, ought to be established not only in England itself, but in the principal cities of our dependencies. Hitherto Rome and Naples have almost entirely monopolised the trade in certain artistic products, the raw material for which is obtained only from the Bahamas.

It is true that years may elapse before they can produce at Nassau cameos and ornaments equal to the magnificent works of art which have proved so attractive, especially to ladies in the Italian Court at the Fisheries; but surely, if there were a well directed school of art, even on a small scale, in the capital, in the course of a little time improvements would be manifested in the designs and in the execution of the articles of personal adornment which enter into the commerce of the colony.

The art of carving cameos, inlaying with metals and tortoise-shell, so as to make articles of elegant furniture—the fabrication of what are called marine jewels and mosaics—and even the manufacture, with the beautiful coloured natural woods, of that exquisite kind of wood mosaic, called in France "marqueterie," are arts by no means difficult to acquire when once proper models, and above all skilful teachers and directors, are procured.

It would be well that attention be drawn to the propriety of the establishment, at first on a small scale, of an art school and museum, where under the tuition of one or two competent persons, English and Italian—the best artists for the purpose—a number of intelligent persons, be taught all that is necessary to enable them, in a short time, to produce workmanship worthy of competing with much of that which finds such ready sale when imported to America from Italy.

Even among the wealthy winter residents there would soon be found a good market for these objects, and I do not fear to predict that in a few years they would enter largely into the exports of an increasing commerce.

It would be necessary at first, perhaps, to expend a little capital, but in a year or so this will be easily repaid. A director and two competent teachers is all the staff needed at first, and be it observed that the best school of art for working men at Munich, began on no more extensive scale. In a short time the school, I am sure, will become self-supporting, and not only a benefit, but a subject of intelligent pride to the islanders, a means perhaps of developing artistic genius of a high order, and also of procuring a respectable and intellectual livelihood to many persons who otherwise might be useless, for the artistic temperament is one which, if not properly utilized, is very apt to rapidly degenerate. I believe I am right in saying that many who have visited Nassau have been much struck by the evident presence of this temperament among the coloured population, and there are many now in New Providence able to speak with authority on this point.

The pink pearls from the *Strombus Gigas* have attracted much attention and admiration, and so prominent an exhibition of them has already resulted in increased demand and enhanced prices.

Many of my fellow colonists will recollect the imprisonment of a Frenchman, Mortimer by name, for selling what were called imitation pearls. He had discovered the secret of the origin of the pearl, and by a clever contrivance aiding the Strombus in developing its treasure. I do not know the grounds on which he was imprisoned, but why not experiment with the object of largely increasing the quantity?

With success the price of the pearl would fall, but the quantity would bring much more important financial results, and thus an export would be created, limited to Bahamas waters, more beautiful than coral, requiring no polishing, and in colour putting in the shade the most expensive and valuable of the Oriental corals.

I cannot forbear being of opinion that the fisheries ought to undergo thorough scientific investigation, and that it would be well to appoint a Commissioner of Fisheries of approved scientific and practical knowledge of marine products, &c., and as to results, I can do no better than refer again to Professor G. Browne Goode's excellent Paper, page 45. He says:—

"On the 9th of February, 1871, Congress passed a joint resolution which authorised the appointment of a Commissioner of Fish and Fisheries. The duties of the Commissioner were thus defined: 'To prosecute investigations on the subject (of the diminution of valuable fishes) with the view of ascertaining whether any and what diminution in the number of the food-fishes of the coast and the lakes of the United States has taken place; and, if so, to what causes the same is due; and also whether any and what protection, prohibitory or precautionary measures should be adopted in the premises, and report upon the same to Congress.'

"The resolution establishing the office of Commissioner of Fisheries required that the person to be appointed should be a civil officer of the Government, of proved scientific and practical acquaintance with the fishes of the coast, to serve without additional salary. The choice was thus practically limited to a single man, for whom in fact the office had been created. Professor Spencer F. Baird was appointed and entered at once upon his duties. Being himself an eminent man of science, for forty years in the front rank of biological investigation, the author of several hundred scientific memoirs, no one could realise more thoroughly the importance of a scientific foundation for the proposed work.

"Pure and applied science have laboured together always in the service of the Fish Commission, their representatives working side by side in the same laboratories; indeed much of the best work, both in the investigation of the fisheries and in the artificial culture of fishes, has been performed by men eminent as zoologists.

"The work of the Commission is naturally divided into three sections:—

"1. The systematic investigation of the waters of the United States and the biological and physical problems which they present. The scientific studies of the Commission are based upon a liberal and philosophical interpretation of the law. In making his original plans the Commissioner insisted that to study only the food-fishes would be of little importance, and that useful conclusions must needs rest upon a broad foundation of investigations purely scientific in character. The life history of species of economic value should be understood from beginning to end, but no less requisite is it to know the histories of the animals and plants upon which they feed or upon which their food is nourished; the histories of their enemies and friends, and the friends and foes of their enemies and friends, as well as the currents, temperatures, and other physical phenomena of the waters in relation to migration, reproduction and growth. A necessary accompaniment to this division is the amassing of material for research to be stored in the National and other museums for future use.

"2. The investigation of the methods of fisheries, past and present, and the statistics of production and commerce of fishery products. Man being one of the chief destroyers of fish, his influence upon their abundance must be studied. Fishery methods and apparatus must be examined and compared with other lands, that the use of those which threaten the destruction of useful fishes may be discouraged, and that those which are inefficient may be replaced by others more serviceable. Statistics of industry and trade must be secured for the use of Congress in making treaties or imposing tariffs, to show to producers the best markets, and to consumers where and with what their needs may be supplied.

"3. The introduction and multiplication of useful food-fishes throughout the country, especially in waters under the jurisdiction of the general government, or those common to several states, none of which might feel willing to make expenditures for the benefit of the others. This work, which was not contemplated when the Commission was established, was first undertaken at the instance of the American Fish Cultural Association, whose representatives induced Congress to make a special appropriation for the purpose. This appropriation has since been renewed every year on an increasingly bountiful scale, and the propagation of fish is at present by far the most extensive branch of the work of the Commission, both in respect to number of men employed and quantity of money expended."

In arranging the corals collected by Mr. Saunders, the similarity of most of them to those of the Mediterranean attracted my attention, and it occurred to me that the red and pink corals, if searched for, might possibly be discovered. I have mentioned the matter since to several eminent men, competent to form a judgment, and all favour it. I will here only quote what Professor Günther, of the Natural History Museum at South Kensington, said to me :—"You are quite right; I think you will find the red corals in the Bahamas. My experience is that whenever a marine product is found in the Mediterranean, it is invariably followed by a similar find in the Japanese and Bahamas waters." Coral has lately been found in Japan, and I say search for it in the Bahamas.

"Where the coral worms in countless nations
Build rocks up from the seas' foundations."

I strongly recommend that your fishermen should be encouraged to search. The dredger used is most simple in construction, and easily made.

As a minimum result to the search for corals, science might benefit as thus described:—

> " A most remarkable series of contributions have been received from the fishermen of Cape Ann. When the Fish Commission had their head-quarters in Gloucester, in 1878, a general interest in the zoological work sprang up among the crews of the fishing vessels, and since that time they have been vying with each other in efforts to find new animals. Their activity has been stimulated by the publication of lists of their donations in the local papers; and the number of separate lots of specimens received, at the present time, exceeds eight hundred. Many of these lots are large, consisting of collecting tanks, full of alcoholic specimens. At least thirty fishing vessels were carrying collecting tanks on every trip, until it became necessary to recall them because no more specimens were required, and many of the fishermen, with characteristic superstition, had the idea that it ensured good luck to have a tank on board, and would not go to sea without one. The number of specimens acquired in this manner is at least fifty or sixty thousand, most of them belonging to species hitherto unattainable.
>
> " Each halibut vessel sets, once or twice daily, lines from ten to fourteen miles in length, with hooks upon them fifteen feet apart, in water 1,200 to 1,800 feet in depth, and the quantity of living forms brought up in this manner, and which had never hitherto been saved, is very astonishing. Over thirty species of fishes have thus been added to the forms of North America, and Professor VERRILL informs me that the number of new and extra limital forms thus placed upon the list of invertebrates cannot be less than fifty."

Steam communication with New York and Florida is most important for the development of the trade. I do not think I should do wrong to designate it the most important subject in my Paper.

New Providence, as a sanitarium and winter resort for the Americans, has a magnificent future. As I write, I picture in my mind's eye a winter—Longbranch, with its comfortable hotels, its rows of pretty cottages along the bay, its excellent drives, and its handsome club house, or casino, in short Nassau, with all the attractions which would induce the wealthy and the invalid to seek its pleasant shelter from the inclement winds of the North.

The reasons for the present only partial success are evident. A large subsidy has been paid for years to companies running ships totally unsuited to the requirements, and the depth of water in the harbour. There has been no regularity in the service. The port has been made an intermediate or secondary one; rates of freight have been excessive, with the object of reducing the volume of imports and exports, and allowing the shortest possible time at Nassau.

Invalids and others, from causes already detailed, have been landed in open boats in rough seas outside the harbour, and submitted to all kinds of risk and annoyance.

A cable to Florida is most desirable.

It is well known that many distinguished persons, political and financial, although recommended to do so by their medical advisers, have refused to visit Nassau, on account of the distance, which the non-existence of a cable has placed them at, from the great centres of social and intellectual life.

Finally, I would observe that if my suggestions were carried out on a considerable scale, the population, with increased prosperity, would soon become much larger, and perhaps the islands, under the newly advocated system of State-directed emigration, might attract to its shores some of the best and most intelligent of those persons who are forced by unkind circumstances and over population to leave their homes in this country.

REPORT

UPON THE

SPONGES OF THE BAHAMA ISLANDS.

By W. Saville Kent, F.L.S., F.Z.S.

Visitors to the International Fisheries Exhibition cannot fail, on entering the Western Corridor, to be struck with the brilliant assemblage of the ocean's treasures that represent the fishing industries of the Bahama Islands. The highly artistic manner in which the specimens are grouped, together with the diversity and completeness of the collection exhibited, reflect the highest possible credit upon those to whom the public is indebted for the unique treat afforded by an inspection of this small but important section. Gorgonias, or flexible corals, of every hue—some forming erect fan-shaped expansions, and others gracefully drooping willowy growths—are commingled in admirable harmony with the more remarkable sponges, madrepores, or stony corals, and sea-shells—having a commercial value—that are indigenous to the coasts of this ocean paradise. In an adjoining case will be found interesting illustrations of economic uses to which certain of this raw material may be converted by the aid of art. pecially worthy of note in this connection are the superb eos cut from the various species of helmet or conch shells—one of these, the *Strombus gigas*, being further famous for yielding the rare and very valuable pale-pink pearl. Artificial flowers, manufactured out of various of the smaller marine shells, constitute, as in Madeira, an important article of export, and are represented by some exquisite specimens in the adjacent show cases. The edible turtle (*Chelone midas*) and the tortoiseshell-producing variety (*Caretta imbricata*) have to be included among the marine products of the Bahamas, as likewise the sea-cucumber or trepang, locally known as "Bêche de Mer." This animal, which, in life, has an elongate worm-like contour, with an anteriorly developed crown of retractile plumose tentacles, belongs to the natural order of the *Echinodermata*—including the star-fishes, sea-urchins, and crinoids, or sea-lilies. In tropical regions, where it is especially abundant, the sea-cucumber (*genus Holothuria*) is extensively used as an article of food—chiefly as a basis for soup—and constitutes an important fishery. The mode of preparing them for the market is as follows: The viscera of the animals are first removed, and they are then boiled for from ten to twenty minutes; they are next thoroughly soaked in fresh water, and then spread out on frames in the curing-houses. In these houses they are smoked and dried by means of fires lit in trenches underneath the frames during a period of four days, and by which time they are ready for market. A large barrel of sea-cucumbers, or "Bêches de Mer," thus prepared, and presenting—in the raw condition—a by no means inviting aspect, is included among the more interesting exhibits of the Bahama series.

By far the most important marine product of the Bahama Islands is, however, that of sponges, and it is to an account of this organic group in general, and of the varieties having a commercial value indigenous to the Bahama Islands in particular, that this little pamphlet is devoted. The sponges of the world number many thousand species, which are distributed with equal abundance throughout the arctic, temperate, and tropical seas. Some inhabit the shallow water close in shore, and are left exposed to the influence of the atmosphere with every fall of the tide; others are exclusively confined to the abyssal depths of the ocean, while a small but interesting minority are denizens of our inland lakes and rivers. Out of the sum-total of known sponges, less than a dozen species, with their many local varieties, all inhabitants of the sub-tropical seas, fall under the category of economic species, and are made the subject of an important fishery. As a matter of fact, the economic value of the sponges of commerce depends entirely upon the nature and arrangement of the materials that compose their skeleton, it being only such lifeless inorganic elements that are present in the article known as sponge when brought to the market. A sponge in its living state—freshly torn from its habitat at the bottom of the sea—bears but little, if any, resemblance to our familiar "companion of the bath" or adjunct of the toilet table. The entire substance of the fine fibrous amber-coloured tissue of which it is, in its commercial form, composed, is, in such living condition, completely hidden within a glairy gelatinous matrix, having somewhat the consistence and aspect of a weak glue, with somewhat denser external pellicle. This glue-like substance represents the organic or animal element of the sponge body, its relationship to the enclosed sponge fibre being essentially identical with that which subsists between our own living tissues and the mate bony skeletons that is contained within them. e process of maceration and washing, the gelatinous flesh is entirely got rid of, and the sponge, in its well-known commercial form, is the residuum.

It is with reference to the composition of the inorganic framework left after the soft gelatinous tissues have been removed that the sponges, as an entire group, are classified by zoologists. All those in which the supporting framework or skeleton is, as in the case of the bath sponge, of a more or less flexible horn-like consistence, are relegated to the order known as the horny sponges, or *Ceratospongia.* In a second group, needle-shaped or variously modified elements known as *Spicula,* having a glass-like or silicious composition, are either added to or entirely replace the horny framework, and is consequently distinguished by the name of the silicious series or *Silicispongiæ.* In a third group, that of the *Calcispongiæ,* a spicula skeleton is likewise developed, but, as indicated by its title, is of a calcareous nature, the component spicules being composed of carbonate of lime. A fourth or relatively small group remains, in which a spicular, horny, or other skeletal framework is entirely absent, the entire sponge body consisting of the easily destructible gelatinous flesh, already referred to as constituting the living element in the ordinary sponge. For this least specialized group the title of slime sponges or *Myxospongiæ* has been proposed. The diversity of external shape presented by the adult sponge-stocks belonging to the several groups or orders above enumerated are found to be almost infinite, the same species, indeed, in a large number of instances, varying indefinitely in this respect. Among the multifarious series that exist, reference may nevertheless be made to some half-a-dozen typical growth, forms which constitute, as it were, a groundwork upon which all the other modifications are built up. Thus, in a very large series of sponges, the typical growth-form takes the shape of a simple encrusting mass, that may be perfectly flat or raised at intervals into more or less prominent hillocks. These prominences may be yet further produced and so subdivided as to give rise to a branching tree-like structure. These several modifications are well illustrated in the common fresh-water sponge, *Spongilla fluviatilis*, that may be obtained abundantly from the river Thames, growing upon the sides of the locks and submerged tree-roots, almost everywhere above the reach of the tidal waters. A more or less solid globular form, varying in the direction of having the centre so hollowed as to constitute a thick walled cup, or further flattened out in the shape of a somewhat saucer-like expansion, represent the more common modifications of the familiar toilet sponge, *Spongia officinalis*. A simple sac-shaped or tubular contour is highly characteristic of the little white calcareous sponges (*Grantia*) and its allies, complex forms with variously branched free or anastomosing tubules, as met with in the genera *Ascandra* and *Leucosolenia*, representing the more specialized modifications of this type. Elongate tubular or so-called "fistular" forms are also abundantly met with among both the horny and silicious sponge groups, the genus *Luffaria* being an example of the former, and the so-called Venus flower-basket sponge, *Euplectella aspergillam*, of the silicious series. This last-named type, which is a native of the Japanese seas, demands somewhat more extensive notice, since it undoubtedly represents, from an artistic point of view, one of the most exquisitely beautiful productions of Nature's handiwork, and is on this account of marketable value as a household ornament. The first specimen of this sponge brought over to this country from the Philippine Islands, some thirty years ago, was sold for no less a sum than £40, and is now on view in the British Museum. At the present day fine examples may be obtained for but little more than as many pence as the original type cost pounds. The *Euplectella*, as sold in the market, being then divested of the buff-coloured gelatinous flesh or *sarcode*, with which it was originally covered, has the form of an elongate, slightly-bent tube, of about one foot in height, which gradually widens towards its free or uppermost extremity. The walls of this tube are composed of *silicious spicules* and fibres, interwoven and amalgamated with one another in such a fashion as to resemble very delicate basket work, wrought out of clear spun glass. A certain number of the larger fibres are disposed longitudinally, and others at right angles, leaving square interstices, the areas of which are further circumscribed and rounded off by the interpolation of smaller spicules. Raised crests of fine anastomosing spicules are developed in an irregularly spiral pattern, upon the outside throughout the length of the tube, the top of which, in perfect examples, is further covered in with a perforated lid of the same silicious network. The base of attachment of this fairy-like structure is finally embraced by a delicate sheaf of long needle-like spicules, which serve to keep the organism securely anchored in the yielding mud at the bottom of the seas which it inhabits. It not unfrequently happens that several examples of a species of crab are found within the tubular cavity of the *Euplectella*, presenting to the uninitiated a problem for solution, akin to that which puzzled a certain crowned head, respecting the apple found inside the dumpling; the crab certainly could not, in its adult state, effect its entrance through the relatively minute interstices of the sponge wall, and the only logical interpretation of the phenomenon is that it passed through in its very young or larval condition, and finding its quarters comfortable, dallied so long as to have outgrown the dimensions of the portals whereby it entered. It was originally represented by the Chinese dealers that the crab was the fabricator of its extemporised silicious cage, and a greater value being set upon those sponges which contained a crustaceous occupant, they resorted to the practice of skilfully removing the base of the sponge, introducing a crab, and fastening it up again in such a manner that the rupture made could not be detected.

Among the notable species belonging to the same group of silicious sponges have to be included the curious glass-rope sponge (*Hyalonema*), originally brought from the Chinese sea, but since obtained from the deeper parts of the Atlantic. The body of the sponge, as in many other forms, is cup-shaped, but supported on a long stalk, consisting of a twisted wisp-like bundle of long silicious spicules that spread out basally in a brush-like manner, and serve like a root, to anchor the sponge in the soft slimy ooze that forms its habitat. A parasitic coral (*Palythoa)* usually encrusts the elongate stalk of this sponge, and these stalks, consisting of tiny glass-like spicules invested by the coral, were at first alone discovered and supposed to represent a complete organism, the sponge body afterwards obtained being treated by some authorities as a parasite. This error in the interpretation of *Hyalonema* received additional support from the circumstance that the Japanese divers, from whom the first examples were obtained, supplied specimens which they asserted to represent their natural growth, with the top end inserted into stones previously bored by the Pholas, and with the expanding brush-like end projecting outwards. Closely allied to the glass-rope sponge are the two genera, *Holtenia* and *Pheronema*, whose bodies are somewhat similarly cup-shaped,. but have the rope-like bundle of spicules, that in *Hyalonema* form a simple stalk, distributed singly or in small fascicles throughout the entire external surface. In *Pheronema Grayi* in particular, obtained by the writer in the year 1871, in connection with the dredging expedition of the yacht "Norma," from a depth of 600 to 800 fathoms, off the coast of Portugal, these filaments, the so-called anchoring spicules, are so thickly developed from the sponge body, and are of such extraordinary length, that the organism presents the appearance of a light blonde wig. Several specimens of this type, known to the local fishermen by the title of the Portuguese birds'-nest sponge, have been presented by the writer to, and are now on view in, the new Natural History Museum. A curious and hitherto undiscovered form belonging to the same group, the hat sponge (*Askonema Setubalense*, S.K.), obtained by the writer from the same locality, is composed chiefly of long thread-like silicious spicula, felted together in such a manner as in both shape and dimensions to closely resemble a very shabby grey flannel boating hat.

All of the several silicious sponges just described, including the *Euplectella*, or "Venus's Flower Basket," the glass-rope, birds'-nest, and hat sponges share, in common, the circumstance that the silicious spicules of which their skeletons are composed belong, more or less extensively, to what is known as the hex-radiate type, that is, are composed of six rays, and are hence as a family group distinguished by the technical title of the *Hexactinellidæ*. It is an interesting fact that the fossil sponges of the chalk formations, familiarly known as *Ventriculites*, exhibit similar structural composition, and were in like manner inhabitants for the most part of the still, abyssal depths of the ocean. The colours of the flesh elements or so-called *sarcode* of living sponges is subject to great variation even among individuals of the same species. Thus in the ordinary sponge of commerce (*Euspongia officinalis*) it runs through various shades of brown, from yellowish grey to black, the dominant hue in one variety being rusty red. In the birds'-nest sponge (*Pheronema Grayi*), when brought up fresh from a depth of 600 to 800 fathoms, the flesh was observed by the writer to be bright orange, and this tint with shades varying from the palest lemon yellow to brilliant scarlet is characteristic of many sponges. The skeletonless Slime-sponge (*Halisarca Dujardinii*) more usually resembles in its natural habitat a little dab or dabs of red-currant jelly scattered upon the surface of the rocks or seaweeds, though at other times this carmine tint is replaced by the equally brilliant hues of sky-blue or purple. Various shades of green are common to many sponge forms; a dark tint of this colour being highly characteristic of the common fresh-water sponge (*Spongilla fluviatilis*), though in this instance it has been recently determined that the colouring agency is due to the presence of a minute parasitic vegetable. The calcareous sponges (*Calcispongiæ*), including *Grantia* and its allies, agree for the most part with one another, and differ from the other sponge tribes, in that their colour, when living, is almost pure white. This is owing to the extreme tenuity and transparency of their flesh and the refraction of the rays of light by the thickly interlacing calcareous spicules of which their skeletons are composed.

Notwithstanding the very wide differences that subsist in their external shape, in the colour, and in the composition and arrangement of the elements that form their skeleton, it will be found that throughout the numerous orders, families and species of sponges, an essentially similar structural plan is associated with their living elements or so-called flesh. The familiar fresh-water sponge (*Spongilla fluviatilis*), already referred to as abounding in the upper reaches of the Thames, may be selected as a suitable type for illustrating the more important of these structural points. On withdrawing a living mass of this sponge from the water, it will be found that a very large portion of the vital elements, will drain away in the form of a transparent slime or mucous. If, in place of leaving it to drain, we immediately detach a fragment or place the whole mass in a glass of water, the following points and phenomena may be observed. A delicate semi-transparent, film-like structure, having much the aspect of a closely-woven cobweb, will be seen standing out from the more solid central substance of the sponge; this structure at one or more points is developed outwards in the form of a conical or cylindrical tube, and is the excurrent aperture or so-called "flue or osculum," out of which, on attentive examination, minute particles of refuse food matter may be seen issuing after the manner of smoke from a chimney-top. A yet closer inspection, with the aid of a pocket-lens or low-power of the microscope, will reveal the fact that an almost indefinite number of very minute circular openings or perforations pierce the substance of the delicate superficial film on every side, and that at these small apertures currents of water carrying the minute organic particles upon which the sponge animals feed, are more or less constantly flowing in; these are the incurrent apertures or so-called "pores." To arrive at a correct comprehension of the internal structure of the sponge, and of the motive force of the incurrent and excurrent streams just described, it is requisite to use a yet higher magnifying power of the compound microscope, and choosing a small transparent example to focus right down into the inner substance of the living sponge. This inner substance is then found to be excavated in every direction into sub-spherical chambers, the walls of which are closely lined with minute ovate bodies or cells. Each of these cells bears at its free extremity a long whip-like appendage or "flagellum," the base of which is surrounded by a very delicate funnel-shaped extension of the cell substance, known as the collar. Minute canals place these flagellated chambers in communication with the incurrent apertures or "pores" of the sponge system, while others leading from the same chambers, freely anastomosing with one another, and thus gradually enlarging their dimensions, finally debouch upon the relatively large excurrent apertures or "oscula." It is the incessant vibratile or lashing action in one direction of the whip-like appendages, or flagella of the cells lining the internal chambers of the sponge, that produce the inflowing and outflowing currents first observed. These flagellated cells absorb and assimilate the food particles brought into the sponge system by the currents they collectively create, and constitute the essential living elements of all sponge structures.

It is interesting to find that among the lowest microscopic forms of animal life, known as the Flagellate Infusoria, organisms exist, having an equivalent structural value only of simple cells that possess, in a like manner, a whip-like flagellum and basal cellar, and are in all other respects structurally identical with these animal elements of the sponge body. Some of these flagellate infusoria or "Collared Monads," as they are more commonly designated, are solitary, while others form social colonies, which may be aggregated on a simple or branching stem, or immersed within a mucilaginous matrix. Excepting that the social monads belonging to the last-named category project directly upon the external surface of this common mucilaginous matrix, instead of indirectly upon chambers with canal communications excavated in its substance, they are to all intents and purposes a kind of sponge, most nearly allied to that group possessing no spicular elements already referred to under the title of the slime sponges or Myxospongiæ. In addition to the flagellated cells that line the excavated chambers, other cell elements, devoid of collars or flagella, and having an irregular shape, which they are, moreover, continually changing, will be found dispersed among the mucilaginous matrix of the sponge body. In the fresh-water type, under discussion, these irregular-shaped so-called amœbiform cells, are somewhat thinly scattered throughout this matrix, but in many other types, notably the Calcareous Sponges, they are so crowded together, especially on the external surface, as to closely resemble a veritable cellular tissue, and have been consequently likened to the integumentary layer or epiderm of the higher animals. The flagellated cells with their hyaline collars that line the internal chambers of the sponge, have in a like manner been compared to the endoderm or lining tissue of the alimentary track of such animals. The motile reproductive bodies liberated from adult sponges, and that ultimately settling down, grow into a sponge-stock like the parent, have likewise been described as possessing similar external and internal cellular membranes. It may, on the other hand, be demonstrated that the non-flagellate amœbiform elements in the sponge body are merely metamorphosed phases of the flagellated cells, differing in no way from the various metamorphic conditions assumed by the simple collared monads, at separate growth periods, and also that the reproductive bodies or so-called ciliated larvæ of the adult sponge-stock, are but ovate aggregates of similar flagellated units.* Viewed from this standpoint, a sponge body may be regarded as a colony stock of unicellular animalcules, or collared monads, including individuals in every stage of development, which throw off and live immersed within a common mucilaginous matrix, and within which matrix is built up, by a process akin to that of crystallization, the spicular or other skeleton characteristic of the specific form to which it belongs. In whichever way interpreted, either as a tissue forming metazoon allied to the corals and all higher invertebrate animals, or as a colonial protozoon, or social aggregate of many thousands of the simplest unicellular animals, the main structural points already described, remain undisturbed, and may be appreciated by the examination of any ordinary sponge, as prepared for domestic use. Taking the finer Turkey cup-sponge by way of example, all the minute perforations that traverse the external surface, represent the areas or so-called "pores," through which, during life, the food-laden currents of water were drawn into the interior substance of the sponge; the wider orifices upon the interior surface of the cup, on the other hand, represent the larger channels or "oscula," by which the same water, having all previously-contained nutritive particles extracted and laden in exchange with fœcal matters is finally discharged. In the coarser variety, distinguished by the title of the bath or honeycomb sponge, the excurrent orifices or oscula are developed upon the convex upper surface, the incurrent apertures or pores being distributed throughout all the intermediate areas and lower surface of the organism.

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* An illustrated account of these collared monads so nearly related to the Sponge, is included in the work, "A Manual of the Infusoria," 3 vols., by W. Saville Kent, F.L.S., F.Z.S., published in the years 1881–82.

A description of the special sponge species, including those indigenous to the Bahama Islands, which possess a high commercial value, with an account of their mode of collection and preparation, may now be proceeded with. To this it is proposed to add a few suggestions in the direction of yet further improving and developing this important fishery. All of the commercial sponges belong to the *Keratose* or horny-fibred sponge order, their value for economic purposes depending upon the fineness, closeness, and elastic qualities of the component fibres of their skeleton. Previous to their discovery upon the American sea-board, and notably in the vicinity of Florida and the Bahama Islands, all the sponges utilised for domestic purposes were obtained from the eastern extremity of the Mediterranean Sea, and from whence, indeed, up to the present day, all the finest qualities are still derived. Notwithstanding their tendency to vary almost indefinitely in form and texture as a consequence of their external surroundings, three distinct specific or sub-specific Mediterranean forms are usually recognised, both by the trade and scientific spongologists, and around which all the other varieties may be conveniently grouped. These three Mediterranean types, as will be presently seen, correspond structurally in a remarkable manner with a similar series that are indigenous to the seas of the Bahamas. The names of these Mediterranean types in the order of their value are, 1, the true Turkey cup-sponge (*Spongia* or *Euspongia officinalis*, Linn.); 2, the bath, horse, or honeycomb sponge (*Spongia equina*, Schm.); and 3, the hard or Zimocca sponge (*Spongia agaricina*, Schm.).

The first or most highly valued of these forms, known commercially as the finest Levant or Turkish cup-sponge, is distinguished by its usually cup-shaped contour and the exceedingly fine elastic and densely interwoven character of its component fibres. Its finest growths are obtained from the Levant and off the coasts of Syria and Tripoli. Poorer qualities of this type are gathered further westward and up the eastern shores of the Adriatic. The bath or honeycomb sponge (*S. equina*) has a more extensive range throughout the Levant, along the north coast of Africa as far as Gibraltar; it is to be recognised by its more subspheroidal form, the absence of distinctly radiating primary fibres, and the irregular honeycomb-like excavations of its entire substance. The third form, the Zimocca or Hard Sponge (*S. agaricina*) varies usually from a flattened saucer shaped to an elevated, irregular nodular outline with large oscular openings distributed at even distances upon its upper surface. The fibre is closely interwoven, much resembling that of the cup-shaped Levant variety; but its texture is much less elastic and is relatively hard and unyielding to the touch; it is confined almost exclusively to the eastern extremity of the Mediterranean, and occurs also in a coarser form in the northern portions of the Red Sea.

Turning now to the American series as typified by the commercial sponges of the best quality obtained from the Bahama Islands, it is found that they likewise may be grouped around three specific or sub-specific forms that correspond very closely with the three leading Mediterranean types above described. It has at the same time, however, to be observed that none of these, as so far obtained, are considered by experts to be equal in quality their Mediterranean congeners. Mr. Alpheus Hyatt, the

American Spongologist, in his 'Revision of the North American Poriferæ,' published in the Memoirs of the Boston Society of Natural History for the year 1876, writes thus: "The coarsest varieties of the European sponges are finer, firmer, and more elastic than the finest of the corresponding American sub-species. This is directly traceable to the larger amount of foreign matter included in their primary fibres, the looser mess of the fibres as a whole, which are also comparatively coarser, and to the larger and more numerous cloacal channels of the American sponges." A type corresponding precisely with the fine cup-shaped toilet sponge of the Levant is not met with in the Bahama waters, its place being most nearly occupied by a form having the popular title of the reef or glove sponge, and technically known as *Spongia officinalis*, var. *tubulifera*. Its contour is more usually dome-shaped, though often very irregular, and it may be fistular or even dendritic. The skeleton consists of very fine closely interwoven fibres. One or more cloacal oscules open upon the top of the sponge, while the remaining general surface is perforated by numerous very regularly distributed minute porous apertures. In old specimens the fibre becomes very brittle and unfit for domestic use. It habits are eminently gregarious, and the localities it more usually affects are a hard bottom or reef in a depth of five or six feet below the surface of the water. The largest examples recorded yielded a measurement of eight inches in height and about twenty in circumference. A sponge that agrees very closely, both in form and structure, with the Mediterranean bath or honeycomb sponge is typified by the Bahaman variety known as the Sheep's-wool sponge (*Spongia equina*, var. *gossypina*). This is by far the most valuable and important sponge variety of the Bahama series, its market value being nearly, if not quite, equal to that of the Turkish form. Like the ordinary honeycomb type, it usually exhibits a sub-spheroidal form of growth, its inner substance being honeycombed in every direction by sinuous intercommunicating channels, and the large excurrent apertures, or oscula, being distributed with comparative regularity throughout its superficies. A characteristic external feature, which readily distinguishes this sponge from its Mediterranean homotype, is supplied by the peculiar tuft-like manner in which the fibres of the external surface of the skeleton are produced in the interspaces between the oscula, and which latter structures are consequently found occupying more or less deep depressions. It is this tufted development of the superficial skeleton that imparts to the sponge that fleecy aspect from whence it derives its popular title. The habitat of the Sheep's-wool sponge is depths varying from three to as much as sixteen feet and deeper, its precise limits not having yet been ascertained. The largest and finest-fibred examples are obtained at the greatest depth, these not unfrequently measuring as much as twenty or thirty inches in diameter, with a height of eight or nine inches. It is a peculiarity, however, of these extraordinary large specimens that the centre portions of their tissue become tender and disintegrated, leaving an outer ring-shaped area of the sponge alone intact. Several remarkably fine samples of such huge ring-shaped Sheep's-wool sponges are now on view in the Bahama section of the Exhibition.

The third type, coinciding most nearly with the Zimocca variety of the Mediterranean sponges, is represented in the Bahama Seas series by what are known as the Hard-head or yellow sponges (*Spongia agaricina*, var. *corlosia dura* and *punctata).* In some respects they nearly resemble the

Sheep's-wool variety, but the texture is denser and yields only to a considerable pressure of the fingers, and they are, consequently, of much less commercial value. This variety is not found in the shallower water, being usually collected from a depth of over sixteen feet. Its habit of growth is more isolated than that of the Sheep's-wool. A height of six, with a diameter of from sixteen to twenty inches, represents the largest examples of this type that have been so far observed. Numerous coarser sponges, not suitable for toilet use, but at the same time of marketable value for outdoor purposes, are obtained in large quantities from the Bahama waters. Among these are included the so-called Velvet, Abacco-velvet, or Boat-sponge (*S. equina*, var. *meandriniformis*), differing from the Sheep's-wool in the absence of the fleece-like tufts upon its outer surface, these being replaced by protruding softened cushions of fibre which somewhat resemble the convoluted ridges of the well-known "Brain coral" (*Meandrina*). Another variety of the coarse-fibred series is the Grass-sponge (*S. equina*, var. *cerebriformis*); it in many respects resembles certain varieties of the Reef-sponge (*S. agaricina*), but may be distinguished from such varieties by the character of the general surface. This is broken up on the sides by parallel longitudinal ridges of irregular length, each of which are ornamented by longitudinal lines of tufts. These ridges are continued upon the upper surface, and give to this region a distinctly radiate pattern. The larger orifices or oscula are disposed in rows in the channels between the longitudinal ridges. A second form—which is likewise included among the so-called Grass or Glove sponges—has been figured and described by Mr. A. Hyatt under the title of *Spongia graminea.* While somewhat resembling the Glove-sponge (*S. officinalis*, var. *tubulifera*) previously described, its texture is much coarser, and its interior substance is exceedingly open owing to the large size and central location of the efferent canals. Its general form is that of a truncated cone, fluted on the side with deep furrows, the truncated apical region being either flat or infundibuliform. The large excurrent apertures debouch upon the truncated surface, while the small apertures are situated on the sides in the interspaces between the ridges. It is a social form growing on reefs either on a smooth surface or attached to corals or to other sponges. The normal dimensions are a height of seven or eight inches with a breadth of five inches. Glove sponges of this size grow commonly at a depth of three feet only beneath the surface of the water, but examples of considerably larger dimensions occur in deeper waters.

Some consideration may now be given to those special conditions that are indispensable to the growth of commercial sponges generally; to those that are favourable to the Bahama region in particular; and to those that would seem in connection with the last-named area to give promise, under intelligent control, of a yet more profitable development of the Bahama sponge fisheries. The conditions of depth and temperature may be cited as of the first importance in connection with geographical distribution of sponges suited for domestic use. Relatively shallow waters, varying in depth from three or four feet to thirty fathoms, represent their bathymetrical range, while a tropical or sub-tropical climate, that in winter does not yield a lower ærial temperature than from 63° to 70° Fahr. on a marine isochryme of from 55° to 60° is absolutely essential for the growth of the prime qualities. These conditions, coincident with the circumstance of their both being in the vicinity of, or embracing extensive archipelagoes, places the two areas of the Mediterranean and Bahama sponge-grounds upon an almost equal footing. It is at the same time, as previously intimated, a generally acknowledged fact, that, compared specifically with one another, the sponges of the Bahama waters are more or less inferior in quality and value to those obtained from the Mediterranean, while the finest type of all, the Levant toilet or Turkish cup-sponge (*Spongia officinalis*), has not, so far, been found on the western shore of the Atlantic. The question has been raised by Mr. Adderley, who has the material welfare of the Bahama Islands so much at heart, "Whether it would not be possible to import and acclimatise this finest quality of the Turkish sponge in the Bahama seas?" Should this suggested scheme be found capable of practical realisation, it is needless to remark that the value of the Bahama fisheries would be enormously augmented. Before, however, incurring the considerable expense that would be necessarily involved in transporting living sponges in proper condition and in sufficient quantity for acclimatisation purposes from the Mediterranean, it would be well to ascertain whether sponges more nearly resembling the finest Turkish form do not already exist in the deeper areas of the Bahama seas. It is a well-known fact that the finest quality of Mediterranean sponges are obtained from so great a depth as from ten to thirty fathoms, and are carefully collected at such a depth by trained divers, with or without the aid of diving apparatus, or by means of drags. In the American waters up to the present time, diving operations have not been resorted to, the sponges being fished up from a depth not exceeding five fathoms with the aid of hooks and spears attached to a long pole. It may be predicted with almost an approach to certainty, that as good and probably better sponges than any that have yet been gathered, are to be obtained from the depths corresponding with those that they inhabit in the Mediterranean, and diving or dredging operations on a small but intelligent scale might be advantageously instituted to ascertain to what extent the opinion here expressed may prove correct.

In the event of sponges of the desired quality not being forthcoming from the American seas, it is recommended that steps be taken to transport thither living examples of the best Levant varieties, and where, being once established, they would no doubt rapidly propagate. That commercial sponges can be artificially cultivated has been proved by experiments made both in the Mediterranean and American waters, the method pursued in each instance being closely identical. The idea that sponges might be propagated by means of cuttings, *i.e.*, large examples cut up into numerous fragments and artificially affixed to a new supporting basis, first originated with Professor Oscar Schmidt, and was practically carried out in the Adriatic Sea by Mr. Gregor Buccich, a telegraph supervisor, in the island of Lesina, in Dalmatia, between the years 1867 and 1872. The operations carried out were conducted by Mr. Buccich with the direct support of the Government and a number of the more prominent merchants of Trieste, a suitable station having been selected in the Bay of Socolizza, at the north-eastern point of the above-named island. The sponges selected were, in their living condition, cut carefully and rapidly into fragments, having the average dimensions of 26 square millimetres, immediately fastened to the objects upon which it was intended they should grow, and then let down to a depth of 5-6 metres. Wooden boxes previously well tarred, to prevent the attacks of the Teredo, with their sides left almost entirely open, and with holes drilled in the top and bottom, into which the sponges were fastened by pegs made of bamboo, were found, as a propagating apparatus, to yield the most favourable results. The chief drawbacks experienced by Mr. Buccich, and which were regarded by himself and those associated with him in making these experiments as sufficiently formidable as to oblige their abandonment, arose, firstly, from the hostile attitude continually displayed by the population of the neighbourhood, who manifested a deep-rooted prejudice against what they looked upon as an undesirable innovation, and not content with constantly disturbing the growing crops with their fishing-nets, on many occasions went so far as to steal the sponges. It was in the second instance found that the sponges planted as cuttings grew so slowly, that as long a period as seven years elapsed before they arrived at a marketable size. As a general result, it was concluded that sponge cultivation, as a financial enterprise, could not be recommended to the attention of private individuals having only a small amount of capital at command; but that, if undertaken by the State, or by capitalists who could afford to wait the time indicated, planting new crops each year, and having the ground efficiently guarded, so as in the end to reap a continuous harvest, it might prove highly remunerative.

The results obtained by experiments conducted at Key West on the Florida Coast in connection with the finest American sheep's-wool sponge (*Spongia equina*, var. *gossypina*) were even more encouraging than those recorded from the Mediterranean. Separate cuttings having an original height of 2½ inches, planted in a depth of 2½ feet of water, grew within six months to over twice these dimensions. It was observed, furthermore, that the first four months out of the six were occupied in their recovery from the mutilation they sustained in the cutting process, and more especially in connection with the skin-like external surface, the remaining two months only representing the period of their growth. A somewhat similar difficulty was encountered in promoting the interference with the crop by the local fishermen, hitherto permitted to fish everywhere without restriction; but the most sanguine prospects of success were reported by the firm, Messrs. McKesson and Robbins, who undertook the experiments, provided that the grant could be secured of a good tidal area of sufficient depth and dimensions and with efficient protection.

The evidence just recorded, showing the practicability of sponge culture under artificial conditions, suffices likewise to demonstrate that the acclimatisation of the finest Levant variety in the Bahama waters would be a relatively easy task. The chief difficulty to be overcome would be the safe transport of living specimens across the Atlantic. To ensure success in this direction it would be requisite in the first place to collect at some port in the Mediterranean a selected cargo of living sponges of suitable size and in the healthiest possible condition. If the director in charge of the Naples Zoological Station (Dr. Antoine Dohrn) could be prevailed upon to lend assistance in this matter, and to place certain of the tanks in the Naples Aquarium at the disposal of the Bahama authorities, the prospects of success of the experiment would be greatly augmented. The specimens selected for transport should be of small size, one or two inches in height and diameter only, and should be attached to their natural basis of support, such as small stones or shells, thus avoiding the great risk of their decaying away, which is invariably associated with examples that have been torn or cut. Tanks suitable for ansit to the Bahama seas would be the next subject for consideration; these should be fitted with a small pumping apparatus that might be connected with the ordinary steam machinery, or might be driven independently by electricity; the end in either case to be accomplished, being the constant circulation and aëration of the water, which would be ***absolutely*** necessary to preserve the sponges in a healthy condition throughout the journey. It might, in addition, be found requisite during certain portions of the voyage to maintain the water, artificially, at or about the temperature of 70° Fahr., by means of steam-pipes connected with the engine boilers, conducted to the neighbourhood of the tanks.

On arriving at their destination, the sponges should be planted out in some one or more of the many sheltered lagoons that abound in the Bahama Islands in depths ranging from three to ten or twelve feet. Under such conditions they could at all times be readily inspected, and their state of health and growth be periodically registered. It would, of course, be necessary to take measures to effectually protect the selected sponge grounds from robbery or interference with by the local or other fishermen. These sponges, once established and effectively protected, would soon develop and liberate germs in such numbers as to secure the naturalization of the species throughout the adjacent waters. An important point has, however, yet to be decided before it can be predicated with certainty, that sponges equal in quality to the finest Levant variety can be successfully cultivated in the Bahama seas. This point is, whether the special conditions that obtain in these waters would favour the growth and reproduction of the imported Mediterranean sponges in their primitive ***fine-fibred*** condition, or, whether under the new surroundings to which they would be subjected they would manifest a tendency to deteriorate into a coarse-fibred type? This latter possibility is suggested, and has to be taken into account in connection with the fact, that no sponges of the finest quality such as the Levant toilet sponge, have been so far obtained from seas productive of reef corals. In the area of the Red Sea, and in that of the east coast of Australia, remarkable in either case for their extensive coral reefs, sponges are relatively coarse and inferior in quality compared with those derived from the reefless Mediterranean. The same rule holds good, likewise, with respect to the existing indigenous sponge-fauna of the coral-producing Bahama and Florida seas. The solution of this important question could be arrived at only by the intelligent examination, at more or less frequent intervals, of selected individuals under cultivation throughout a period of some years' duration, special attention being directed to any alterations in the character of the fibre, as revealed with the aid of the microscope, developed upon the original framework of the sponges brought from the Mediterranean. Until a practical decision has been arrived at in this direction it would be scarcely desirable to expend a large amount of capital in the importation of living Mediterranean grown examples.

Apart from the proposed acclimatisation of European sponges in the Bahama seas, much, doubtless, could be accomplished towards the improvement and further development of the existing fisheries. That sponges of a yet finer quality than those, so far obtained from this locality are possibly to be gathered with the aid of the dredge from the deeper waters has been already suggested on a previous page. The question has recently arisen as to whether or not the existing sponge beds, if continually ed, as at present, are not likely in process of time to become exhausted, and whether to guard against such an untoward eventuality it would not be desirable to institute a periodical close time for their protection, such period to be made coincident with their reproductive season. It is not anticipated by the writer, that so long as the sponge fisheries in the Bahama Islands are conducted upon the present primitive method, the sponges being individually transfixed with a hook or spear, that there is any likelihood of the beds being injuriously depleted; for by the method now pursued, it is only the larger sponges that are of a mercantile value that are fished up, the young individuals being overlooked or left to grow to a marketable size. Before attaining to this condition, sponges freely evolve their reproductive gemmules, so that the constant restocking of the beds is effectually provided for. If, on the other hand, the present mode of fishing should be superseded by the use of the dredge without restriction, and to such an extent that the entire area of the ground would be systematically swept clean of all sponges, great and small, the complete exhaustion of the sponge beds would doubtless be only a question of time. To provide against such an emergency, the following precautionary measures might be adopted:—The dredging operations should be restricted to a certain distance from the coast line, leaving a wide inshore margin, in which the sponges could freely propagate. Dredging operations should not be permitted over the same sponge beds for a number of years in succession, but portions of the entire area in turn should be allowed a more or less extensive resting time, during which interval a new crop of sponges might establish itself or grow to maturity. Certain favourable areas might be separated off *permanently* as stock beds or nurseries, either naturally productive of, or artificially planted with the best kinds of sponge, and from whence germs or embryos would be constantly liberated and distributed throughout the adjacent waters.

In the writer's opinion, the precious coral of commerce (*Corallium rubrum*), and probably also the pearl oyster (*Meleagrina margaritifera*), if not *already* existing, though yet undiscovered, in the adjacent waters, might be artificially introduced and successfully cultivated in the Bahama Islands under conditions closely analogous to those here suggested with reference to Mediterranean sponges.

The subject is, at the least, well worthy the attention of those interested in the further development of the fishing industries of the Bahama seas.

WEST AFRICAN FISHERIES,

WITH PARTICULAR REFERENCE TO

THE GOLD COAST COLONY.

BY

HIS EXCELLENCY CAPTAIN C. A. MOLONEY, C.M.G.,

COLONIAL SECRETARY AND ACTING GOVERNOR OF THE GOLD
COAST COLONY.

> "Bait the hook well; this fish will bite."
> "It is lawful for you to fish in the sea, and to eat what ye shall catch,
> as a provision for you and for those who travel."

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CONFERENCE ON OCTOBER 24TH, 1883.

The Honourable SIR AMBROSE SHEA, K.C.M.G., Commissioner for Newfoundland, took the Chair.

ON WEST AFRICAN FISHERIES, WITH PARTICULAR REFERENCE TO THE GOLD COAST COLONY.

IN explanation of my acceptance of the invitation of the Executive Committee of the International Fisheries Exhibition to write a Paper on "West African Fisheries, with particular reference to the Gold Coast Colony," I must ask to be allowed to preface what follows by an acknowledgment of the fact that whatever knowledge of the subject I may possess is confined mostly to the breakfast and dinner table; and I am doubtful whether in my shallowness or taste I am an exception.

When I ventured to undertake this Paper, it naturally first occurred to look about for information, and to thus endeavour to reap a harvest on the brains of others; but to my inquiry of unscientific and worldly friends as to what they knew of the fish fauna, the invariable answer I received was—"At present, my dear fellow, cod is in season," or some like communication. "As regards that awful place West Africa, comparatively nothing has been written, for the general belief is that even fish won't live there."

Now, on the contrary, much has been written. The fauna literature applicable to West Africa is extensive, although scattered, and I am, in consequence of limited time, and of appreciation for the patience of my kind listeners, unable to carry out an original intention to refer in detail to it; yet I may hurriedly allude, as convenient references for any future enthusiastic disciples, to—

The 'Geographical Distribution of the Zoological Record.'

Günther's 'Catalogue of Fishes.'

Günther's 'Study of Fishes.'

Dr. Savage's 'Study of the Ichthyological Fauna of the Ogooué' (in Gaboon), 1880.

Dr. Rochebrune's 'Fish Fauna of the Senegambia,' 1883.

To our shame, zoological work and its record are making headway in other Possessions than our own. Look to the admirable works just quoted of Doctors Savage and Rochebrune. They have but recently come into my hands, so that time, even if space did so, will not admit of my taking advantage of them.

Of the zoological division of the earth's surface as proposed by Mr. Sclater, the Ethiopian region stands forth as including Africa south of Sahara, Madagascar, and the Mascerene Islands, also southern Arabia.

Then again as to the fauna of fresh-water fishes, Dr. Günther has proposed the division into zones, among which stands the equatorial zone, noted by the development of Siluridæ, and characterised as far as the African region is concerned by the presence also of *Dipnoi* and *Polypteridæ*, *Chromides* and *Characinidæ*, being numerous, with *Mormyridæ* present and *Cobitidæ* absent.

This authority has further divided the equatorial zone into four regions, one being described as African, with which we have now more to do than with any other, but which cannot according to him well be treated as to its fish fauna as absolutely distinct; for there "exists, for instance, a great affinity between the Indian and African regions; seventeen out of the twenty-six families or groups found in the former are represented by one or more species in Africa, and many of the African species are not even generically different from the Indian," and as the majority of these groups have many more representatives in India than in Africa, it has been assumed "that the African species have been derived from the Indian" stock, but even to such an assumption there are exceptions.

The African fresh-water region comprises, according to Dr. Günther's arrangement, the whole of the African continent south of the Atlas and the Sahara, but for the purpose of this Paper, in which I treat of the marine fauna as well, I would dwell generally on the western coast line of that Continent lying between 30° N. lat. and 35° S. lat., for within such latitudes lie not only the coast line and adjacent waters, but also the Canaries, Cape Verde Islands, Fernando Po, Princes Island, St. Thomas and Annobon, to which I would like to make a brief reference.

I am, apart from interest, the more induced to so act as "the difference between the tropical and southern parts of Africa consists simply in the gradual disappearance of specifically tropical forms, whilst *Siluroids*, *Cyprinoids*, and even *Labyrinthici*," which are peculiar to the warmer latitudes "penetrate to its southern coast"; thus "no new form entering to impart to South Africa a character distinct from the central portion of its Continent."

Whilst deciding not to encompass in this Paper widely spread comparisons even as far as the African region goes, extending in the north-east as to its fauna by the Isthmus of Suez into Syria, "the system of the Jordan presenting so many African types that it has to be included in a description of the African region, as well as of the Europo-Asiatic," I may say that two hundred and fifty-five species of known fresh-water forms inhabit it, contracted into thirty-nine families or groups, of which fifteen are represented in the African, as against twelve in the Indian region. Further, the African species, as compared with the Indian, are represented in the proportion of two to five, due, it is advanced, to the greater uniformity of the physical condition of the African continent, and to the almost perfect continuity of the great river systems, which take their origin from the lakes in the centre.

"This," says Dr. Günther, "is best shown by a comparison of the fauna of the Upper Nile with that of the West African rivers. The number of species known from the Upper Nile amounts to fifty-six, and of these not less than twenty-five are absolutely identical with West African species. There is an uninterrupted continuity of the fish fauna from west to the north-east, and the species known to be common to both extremities may be reasonably assumed to inhabit also the great reservoirs of water in the centre of the continent. A greater dissimilarity is noticeable between the west and north-east fauna on the one hand and that of the Zambezi on the other; the affinity between them is merely generic; and all the fishes hitherto collected in Lake Nyassa have proved to be distinct from those of the Nile, and even from those of other parts of the system of the Zambezi."

"Africa, unlike India, does not possess either alpine ranges or outlying archipelagoes, the fresh waters of which would swell the number of its indigenous species; but at a future time, when its fauna is better known than at present, it is possible that the great difference in the number of species between this and the Indian regions may be somewhat lessened."

To give a more extended but brief comparison of the fresh-water fauna of the African, as against the other regions, I would quote that:

"The regions with which Africa (like India) has least similarity are, again, the North American and Antarctic. Its affinity with the Europo-Asiatic region consists only in having received, like this latter, a branch of the *Cyprinoids*, the African Carps and Barbels resembling, on the whole, more Indian than Europo-Asiatic forms. Its similarity to Australia is limited to the two regions possessing *Dipnoous* and *Osteoglossoid* types. But its relations to the two other regions of the equatorial zone are near and of great interest."

And in the affinity of the fresh-water fishes, as regards Africa and South America, I must trespass on your patience by asking to be allowed to read as follows:

"The existence of so many similar forms on both sides of the Atlantic affords much support to the supposition that at a former period the distance between the present Atlantic continents was much less, and that the fishes which have diverged towards the East and West are descendants of a common stock, which had its home in a region now submerged under some intervening part of that ocean. Be this as it may, it is evident that the physical conditions of Africa and South America have remained unchanged for a considerable period, and are still sufficiently alike to preserve the identity of a number of peculiar fresh-water forms on both sides of the Atlantic. Africa and South America are, moreover, the only continents which have produced in fresh-water fishes, though in very different families, one of the most extraordinary modifications of an organ—the conversion, that is, of muscle into an apparatus creating electric force."

The lagoons, or inland waterways, that run parallel to the sea, especially on the Guinea coast, presenting, as regards their formation, such an interesting geological study, afford a grand and rich field for the study of the brackish-water fauna, among which are mentioned, so far as I may specially give, in connection with the equatorial zone, the *Rajidæ*, *Sciænidæ*, *Polynemidæ*, *Caranx*, *Chatoessus*, *Megalops*, and *Syngathidæ*.

Of lagoons I may give here the opinion of the authors of 'To the Gold Coast for Gold,' which is expressed as follows:

> "The formation of these characteristic African features, which either run parallel with, or are disposed at various angles to the coast, is remarkably simple. There is no reason to assume with Lieutenant R. C. Hart that they result from secular upheaval (page 186, Gold Coast Blue Book, London, 1881). The 'powerful artillery with which the ocean assails the bulwarks of the land, here heaps up a narrow strip of high sand bank, and the toils of the smaller streams are powerless to break through it, except when swollen by the rains. They maintain their level by receiving fresh water at the head, and by percolation through the beach, while most of them are connected with the sea."

Next as to marine fishes. Of the shore-fish—term applied to the fish inhabitants of the immediate neighbourhood of land either actually raised above, or at least but little submerged below the surface of the water—of the equatorial zone, Dr. Günther states that as regards the tropical Atlantic and Indo-Pacific fauna, the differences are far less numerous and important than between the fresh-water or terrestrial fauna of continental regions. The majority of the principal types are found in both, many of the species being even identical; but the species are far more abundant in the Indo-Pacific than in the Atlantic, which is attributed to the greater extent of archipelagoes in the former. He continues—

> "But for the broken and varied character of the coasts of the West Indies, the shores of the tropical Atlantic would, by their general uniformity, afford but a limited variety of conditions to the development of specific and generic forms, whilst the deep inlets of the Indian Ocean, with the varying configuration of their coasts, and the different nature of their bottoms, its long peninsulas and its archipelagoes, and the scattered islands of the tropical Pacific, render these parts of the globe the most perfect in the development of fish life."
>
> "The boundaries of the tropical Atlantic extend zoologically
> egrees beyond the northern and southern tropics; but as

the mixture with the types of the temperate zone is very gradual, no distinct boundary line can be drawn between the tropical and temperate faunæ.

"Types almost exclusively limited to the tropical Atlantic, and not found in the Indo-Pacific, are few in number, as *Centropristis*, *Rhypticus*, *Hæmulon*, *Malthe*. A few others preponderate with regard to the number of species, as *Plectropoma*, *Sargus*, *Trachynotus*, *Batrachidæ*, and *Gobiesocidæ*. The *Sciænoids* are equally represented in both oceans. All the remainder are found in both, but in the minority in the Atlantic, where they are sometimes represented by one or two species only (for instance, *Lethrinus*)."

It would seem that—

> "As with fresh-water fishes, the main divisions of the shore-fish fauna are determined by their distance from the equator, the equatorial zone of the fresh-water series corresponding entirely to that of the shore-fish series."

Although as regards the latter, the fauna is more extended north and south in its distribution from the equator.

Dr. Günther's 'Study of Fishes' affords, from page 275, a list which, although only containing the principal genera or groups of coast-fishes, in the Equatorial zone, yet admits of the formation of an opinion on the affinity of the Tropical Atlantic and Indo-Pacific, and to it, for more detailed information generally in what I have ventured to extract, I would beg leave to refer my hearers.

There are included in the list ninety-six families or groups of shore-fishes in connection with the Tropical Atlantic and the Indo-Pacific, in the proportion of 59 to 87, and although these are not specimens of each genus common, yet the proportion of the species stands as 532 to 1917.

Pelagic fishes, viz., fishes inhabiting the surface of mid-ocean, like shore-fishes, are most numerous in the tropical zone, and with few exceptions—*Echinorhinus*, *Psenes*, *Sternoptychidæ*, *Astronesthes*—the same genera occupy the Tropical Atlantic as well as the Indo-Pacific.

> "The pelagic fauna of the tropics gradually passes into that of the temperate zones, only a few genera, like *Cybium*, *Psenes* and *Antennarius*, being almost entirely confined to the tropics."

Among the fish off and within this coast line, I may explain ordinarily, are met sharks, cat-fish, albacore, bonito, rays, blennies, barracouta, grey mullet, ctenopoma allied to the climbing perch, the "fighting fish," flat-fish, carp, flying fish, electric fish, herring, anchovy, mud-fish, eels, "shine-noze," "rock cod," sun fish, "globe fish," perch, mackerel, sword-fish, dolphin, pilchard, &c.

Most of the works one takes up on this part of Africa point to the importance of the fresh-water fish industry as a means of support for the natives, and many allude to the grand sea-fish field represented by the tropical Eastern Atlantic.

Bosman, in his 'Coast of Guinea,' written nearly two hundred years ago, affords particulars of the value of sea and fresh-water fish to the natives.

Tucker, in his 'Narrative on Expedition to the River Zaire,' dwells upon the "swarms" of albacore, bonito, and other fish met with in the Gulf of Guinea, on the voyage in 1816 of the "Congo," as also of the importance and richness of the fish field of the river of same name (the then Zaire, now Congo).

Bowdich and Dupuis testify to the quantity of fish to be met with in the rivers of the Ashantee kingdom and of the other surrounding countries, and of its necessity as an article of food.

Bowen, in his interesting 'Central Africa,' alludes to frequently seeing fish exposed for sale in different interior markets of the Yoruba kingdom, and to the richness of its streams in this commodity.

The importance of the fisheries in that part of the world and their growth did not escape the notice of the Select Committee of the House of Commons on the West Coast of Africa (1842), when Mr. Swanzy, of the firm bearing his name, conveyed that there was a great deal of fishing there, and that it "forms, as well as salt, a great article of commerce between the waterside and interior people."

Of the country behind the Portuguese Possessions in South-West Africa, Messrs. Capello and Ivens in their "from Benguela to Yacca," state of the river Luando, "it is extremely abundant in fish; its banks are visited by numerous tribes, who devote their attention to fishing, using for this purpose the 'mu-ghande,' snares of various kinds." "So abundantly is this river supplied that, as we were assured, it furnishes, jointly with the lakes of Quihonde and Catete, more to the north, and the Njombo, one of its affluents, sufficient fish for the large requirements of the Songo country."

Schweinfurth, in his 'Heart of Africa,' alludes frequently to the plentifulness of fish in the rivers in tropical Africa which lay in his path, and also records the abundance ot crocodiles and hippopotami. Writing of the modes of capture adopted by the natives, he states:—"They proceed very much in the European way of damming up the stream by weirs, and laying down wicker pots of considerable size. The fishing, for the most part, is done twice a year, first at the commencement of the rainy season, and again when the waters begin to subside."

The importance that attaches to certain of the Ganoids (of which so many specimens are extinct, and are of great geological interest), such as *Protopterus annectens*, *Polyp-*

terus Senegalus, *Calamoichthys*, induces me to briefly mention them here. The first abounds in many places, and forms an important article of food. It is to be frequently seen at the native markets in a smoked condition, almost black, and secured in numbers in circular form on bamboo skewers.

As to deep-sea fishes, viz., those which inhabit such depths of the ocean as to be but little or not influenced by light or the surface temperature, I do not feel, in view of object and scope of this Paper, called upon to dwell.

Philanthropic and scientific expeditions undertaken at various times in the past, point to the fertility of the Eastern Atlantic as a fish-bed, but it is evident that sufficient advantage, compared with the fruit to have been reaped, has not been taken of nature's bounty; and as regards West Africa, a comparatively new and scientifically unknown region, other mercantile and more popular attractions and manias have caused the fish industry to be now what it was a hundred years ago, aye, more, *ab initio*, the primitive calling and promotion of the aborigines in whose hands it has been and is, but towards whom more interest of a practical nature should have been, and, it is to be hoped, will be directed in the matter, at least, of the improvement of the system of catch and healthy supply.

West African Settlements.

The West African Settlements, commonly understood as Sierra Leone and the Gambia, were reconstituted under Letters Patent of the 17th December, 1874, into one Government, comprising Her Majesty's Settlement of Sierra Leone, embracing all places, settlements, and territories which may at any time belong to Her Majesty in West Africa between the 6th and 12th degrees of N. latitude and lying to the westward of the 10th degree of W. longitude, and Her Majesty's Settlement on the Gambia, comprising all places, settlements, and territories which may at any time belong to Her Majesty in West Africa, between the 12th and 15th degrees of N. latitude, and lying to the westward of the 10th degree of W. longitude.

The population of the British Settlements on the Gambia was given, in 1881, as 14,150, of whom 105 were Europeans, including crews of ships in harbour. Of the total, 296 were returned as fishermen and native seamen, whose pursuits are mainly, if not altogether, confined to the river Gambia.

On the Gambia fisheries, the Blue Books say that "there are none except for the daily table supply, which is varied and abundant. Canoes are employed in fishing."

The values of imports for 1880 and 1881 are returned as £191,580 and £142,589. These figures include £735 and £1,205 as value of imported salt. Information is not particularised of the introduction of any foreign fish.

The population of Sierra Leone and its dependencies was given, in 1881, as 60,546, of whom 271 were whites, inclusive of 108 crews of vessels in harbour. Of this total there were 1,964 fishermen and native seamen, on whom the Colonial Secretary reported as follows:—

"Of the fishermen and native seamen, who number nearly 2,000, more than half may be said to be fishermen, who, beyond providing themselves and their families with the means of subsistence, contribute but little to the comforts of the inhabitants, and practically nothing to the State. The native seamen, taken all round, are an ill-paid and ill-conditioned class, who endure many hardships, and who appear to have at present but a slight chance of ameliorating their condition."

The value of imports for 1880 and 1881 are returned as £491,993 and £374,375. These figures include £781 and £336 value of imported fish, as also £4,145 and £2,930 for introduced salt. Boats and canoes, licensed in 1880 and 1881, were 689 and 572.

It would be unnecessary and unimportant to give here the local names of fish. You will be amused, but not enlightened, to hear that some are "Blue Billies," others "Black Billies," information which would defy, for the purpose of classification, the ingenuity of any fish Authority.

French West African Settlements.

As to the French Possessions, generally referred to as Senegambia, Gaboon, and Assinee, with a returned population (1878) of 324,038, I know of no systematic fish industry beyond, perhaps, the requirements for a hand-to-mouth existence and precarious inland trade.

Gold Coast Colony.

It is very difficult to form an estimate as to the numbers of any native population of a somewhat migratory character and of a Protectorate, for we must remember that Her Majesty's Settlements on the Gold Coast are represented by "Colony" and "Protected Territories," the statements alone of natives as to numbers being uncertain, and, I may say, quite unreliable.

Then, again, natives are peculiarly suspicious, and would be disposed to be at once on their guard against supplying information which they would view as intended to be directed against themselves in the shape of taxation, perhaps conscription, as was fancied at places in the Ashantee
, 1873-4.

approximate value of the fisheries can be given.

Data are not forthcoming. The population of the Gold Coast cannot, it would seem, be got within the range of "practical statistics." It will be ideal to state that most of the people, estimated in round numbers say at 400,000, live chiefly on fish, so that some conception can be formed of the considerable catch there must be annually to supply such a mass, as also the great unlimited interior markets beyond our jurisdiction.

The Gold Coast Colony—prior to the following date made up of the Settlements on the Gold Coast and the Settlement of Lagos—comprises, according to Letters Patent of 22nd January, 1883, all places, settlements, and territories belonging to Her Majesty the Queen in West Africa, between the 5th degree of W. longitude and the 5th degree of E. longitude. It must not be understood that the colony is one and undivided, for a strip of coast and country commonly known as the Dahomean sea-board and territory intervenes.

The population of the Gold Coast has, as already stated, never yet got beyond an estimate. Lagos was, however, more favoured, for in 1881 the census effort there applied and gave its population as 75,270, inclusive of 117 whites and 68 mulattos, of whom 5,695 were returned as fishermen.

In view of what I have explained, it will be very evident that it would simply be farcical to endeavour to foist on to you any estimate of catch or of cure; indeed, such particulars are not arrived at even in England. But against whatever may be the consumption of locally-caught and preserved fish, it may be interesting to have, by way of comparison, the value of what has been imported of this article—which I give for four years:—

Year.	Value of fish imported. Gold Coast.	Value of fish imported. Lagos.	Value of total imports. Gold Coast.	Value of total imports. Lagos.
	£. s. d.	£. s. d.	£	£.
1878	370 0 5	176 3 2	394,152	483,623
1879	174 15 10	435 9 1	323,039	527,871
1880	No statistics.	576 9 0	337,248	376,215
1881	248 1 11	273 15 8	398,123	336,659

There has been no exportation of fish—naturally. Imported fish, which is brought mainly from the United Kingdom, Germany, and America, is chiefly represented by tinned and smoked salmon, lobster, sardines, salt cod and ling, red herrings, and mackerel, and is supplied to meet the taste of Europeans and Europeanized natives. The aborigines, as a rule, prefer their own fish, as will be explained later.

For my own part, I would not be prepared to view these statistics as giving the fishing population, for natives often combine the work of farming with fishing. There are, of course, some who are merely fishermen and nothing more, or rather, when they are anything more, they are idlers; although I am glad to acknowledge I have seen many an exception to this, in men who have turned, and do turn during leisure time, their hands to some other remunerative work than fishing; while there are others—and a large number—who do not confine themselves to fishing as a sole means of livelihood, but as a subsidiary occupation. Idleness, notwithstanding, prevails much, but this may be excusable in view of absence of competition as regards production, as also of conditions of climate, and the, fortunately for them, small demand made on them towards food provision, Nature having been, and being, so bountiful.

The fishing craft is represented altogether by the canoe, "the dug-out," of varying sizes, regulated by the number of persons carried, viz., from five to one. They are generally hollowed out, by the adze and burning of the trunk, of the silk cotton (*Bombax*), or of a species of fig. Canoes most frequently used are those for three persons; they are propelled by paddles, the shapes of which vary tribally, the occupant (or occupants) resting on his knees, on his haunches, or standing erect, or perched on seats—cross sticks, secured by tie-tie on gunwale of canoe.

They are sometimes built up at the sides when required for commercial transport purposes, for ferry-boats or as war-canoes. The ordinary sized fishing canoe is propelled by three men, one of whom, occupying the stern, propels and steers, his main duty being the latter; and in their management of the craft they are surprisingly clever.

Transport is mainly effected by means of rivers and lagoons, viz., inland waterways, so far as water can be made use of, and on the heads of natives by land, as was experienced in the Ashantee war, 1873-4.

For water transport, canoes abound. The carrying power of canoes is judged by the number of persons or casks of oil each will carry. Their sizes accordingly vary from what can contain from two to eighty persons, or from two to sixteen puncheons of oil.

Bar-boats of seven to eight tons have been used at Lagos; only for commercial purposes, as the means for the transfer of cargoes from ship to shore, and of produce from shore to ship. They have been only used by the mercantile houses, but since the African Steamship Companies have supplied to Lagos and the rivers their own branch steamers, the number of bar-boats have considerably decreased, and their use is daily becoming a thing of the past.

Sea fishermen usually pursue their avocations in the day; they rarely work at night; but to this rule there are exceptions, while in the lagoons fresh-water fishing is conducted at times both day and night.

On moonlight nights, when fishing is conducted on the inland waters or rivers, the men make use of a piece of glass—broken bottle—and metal, thereby making a musical tinkle to attract the fish before the hand net is cast.

Sea fishermen, as I have said, rarely work at night. They usually start to fish at daybreak, and return about two or three o'clock in the afternoon. They are received on the beach by a large crowd, comprised of purchasers in the person of subsequent retailers and cooks: wives to witness the luck, children to carry back, as they had brought, the nets and fishing-gear and their fathers' spoil, scoffers to chaff in case of capsizing, or of return empty-handed. Canoes frequently capsize, having been caught broadside on by a roller, or at times they are turned completely round and then go over; the fishermen invariably hold on, right the canoe, bale her out, re-embark, and pursue what remains of their journey. When bad weather is expected, and they anticipate being capsized, the fishing-gear, as also their catch in reed bags, is secured to the cross-thwarts of the boat.

Sea fishermen act as a barometer, for their movements and energy depend somewhat on the weather and condition of the sea. I have often watched them repair to the beach, run out their canoes to the edge of the surf, make a few abortive efforts towards departure, shrug their shoulders, with a "not good enough" meaning, at the weather, their mind being at ease as to the morrow, by probably having had a good haul a day or two previous, run back their canoes, and return "not ingloriously" to their homes.

The fishermen, in costume for work, are almost in a state of nature—and very wisely so—in view of the treacherous nature of surf, and of greater facility for paddling, and of less likelihood to contract disease. They are seen with a loin-cloth, of meagre dimensions, as a body cover, and for the head perhaps a broad-brimmed hat, or may be they are bareheaded. They take frequently with them their country clothes, a loose sheet-like body-covering wrapper, which, when worn, is carried toga-like, as illustrated in the views before us. These clothes may be seen on the return of the canoes wound around the head of their stalwart owners, to act as a sun-awning or umbrella. At times they are converted, as make-shifts, into temporary sails, although canoes are usually supplied with sheets of a like nature, or with sails made of fibre or leaf matting. The sail is square, or nearly so. There is a single mast—a bamboo pole—to the head of which the sail is either hoisted by means of a small line run through a hole made through the mast-head, or made fast with a seizing. The sail is spread by a bamboo "sprit," and is worked by means of a sheet and a brace on the sprit; usually one man holds these, while the other steers with a paddle, but sometimes one man performs both duties. There are occasions when the luff of the sail is "bowlined out" by means of another bamboo.

Very rarely accidents by drowning occur. Of fishermen it might almost be said that they were amphibious. As children they are generally made pursue the calling of their fathers: they are to be seen all day long, especially in the heat of the day, in the water, either swimming, "turning turtle," engaged paddling a plank or remnant of a canoe, or learning the art of casting the net. In later years they frequently accompany their fathers, and learn their handicraft, and, when old enough, take to the industry themselves.

That West Africa affords a good stock for the development of a useful fish population may be inferred from the doings of their fellow-countrymen in the United States, where some 5,000 Negroes conduct chiefly the shad-fisheries, and "are employed during the shad and herring season in setting and hauling the seines." In the shore fisheries of Key West, Florida, Negroes "are considered among the most skilful of the sponge and market fishermen." Some Negroes are also to be found among the crews of the whaling vessels of Provincetown and New Bedford, United States, the latter alone representing over 200.

I must not forget the Kroo-boys — fine good-natured fellows, instinctively watermen, almost amphibious. Their native home is in the country of Sinou in the central part of the Republic of Liberia.* They are to be found all along the coast; in fact, I don't know what the coast would do without them. They are invaluable, and represent the most generally useful—whether ashore or afloat—and important tribe on the West Coast of Africa. Without them it would be difficult to work, on this malarial coast, our men-of-war, mail steamers, foreign vessels, all loading and unloading being done by them. I applied to them the term amphibious; well they are known, in fact it is a frequent practice, to swim off, pushing their casks of oil before them, from their own coast to trading vessels lying at anchor some one or two miles off. They are equally useful on shore.

Fisheries as to their economic value depend on quality, supply, and demand. Where a want equals the catch of the finny tribe, an industry may be viewed as healthy, whether the supply be marketable and local, or whether—which is another consideration, and one more to the point as regards this Paper—local consumption or industrial demand, or both, does not equal the catch, and as a consequence the surplus has to be and can be profitably sent to more distant markets where disposal will readily follow. In the latter case so much would naturally depend on the available means and effective conveniences of transport, especially as to the disposition of fresh fish, or the effectiveness of curing where climate and circumstances put beyond consideration the transit of fresh fish. As a rule, it may be said of the tropics, that fresh fish, to be enjoyed, must be consumed on the day of the catch. It does not always admit, indeed, of this—and the surplus captures, if energy prove sufficient for such an issue, are cured and sent to inland markets that offer.

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* Liberia with a coast line of some 600 miles, and extending inland les, with a native population estimated at 1,068,000.

My remarks are meant to apply to the Gold Coast Colony, where the people may be described as a fish-eating population, and where caste prejudices do not exist. Fetish restrictions may be at times, but rarely, imposed on the catch or consumption of this article of diet, but charity begins at home even with the Fetishman—who is often a fisherman, and, when not, is the recipient of "dashes" from the sea in the shape of fish by the propitiators of the sea-god; thus he would not be so short-sighted as to impose any restrictions on so needful and essential a commodity, especially when he would know that, were he to do so, his power of imposing obedience might be jeopardised by seafarers.

It may be as well to add here that sovereign water rights are at times exercised in Native States through the medium of a fetish—to wit—the "Adanve" over the Denham waters,* which have been and are through its instrumentality, subject to the Government of the King of Katanu—a right that has been recognised and acknowledged by all the surrounding tribes.

Ponds of fish, the subject of worship, are to be at places met with. Rivers also represent resorts, in the native mind, of favourite fetishes. The fetish of the river Tando is a favourite one of the Ashantees ; Cobee, a river in Denkera, and Odentee in the Adirree, are two others.

The river "Dah," in Ashantee, receives annual ablutions and offerings in thanks to its Fetish for the yam of the year—the Adai custom.

The sea-god has also offerings and propitiatory attentions.

Of sea-fishing, I am unaware of any close season ; but there are times when the fishing of some of the rivers and lagoons is by fetish order forbidden, in reality to allow of the growth of fish which is of general interest. Opening ceremonies after such "close times" are interesting and important events.

In a country where local demand keeps pace with the population, and where the cost of fishing-gear is comparatively trivial, when it is remembered that the value of time is not yet known, so that the estimate of labour in the computation of outlay on appliances is not of much moment, the question of supply may be said to be favourably met ; whereas as to the demand, the sale-market is large and wide enough, representing, as it does, a huge interior, but a clammy and damp, at the same time hot climate, bad roads, no other means of transport but in baskets on the heads of natives, imperfect system of curing, stand forth as obstacles, and indeed great ones, towards the development and growth of a healthy inland fish traffic.

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* Behind the Dahomean seaboard.

Natives object to travel by land at night, and there is no interior demand of such a nature as to make such an effort worthy of the trouble in a pecuniary sense. No grand central Billingsgates exist to which fish could be taken fresh, and be at once disposed of. There are, however, regular native appointed markets held on certain days of the month or week, where, with other articles, dried fish is taken for sale, whence it is for the most part procurable.

Operations for the capture of the different forms of marine and fresh-water life are conducted from the sea beach and banks of inland waters, but as a rule by canoes, and effected by the following means which, with perhaps certain modifications, to meet tribal tastes or progress, apply, I am led to believe, generally to the Gulf of Guinea; in fact, a look at the specimens of fish gear from other tropical parts might justify a more extended application.

I may remark that the descriptions which follow refer more directly to the fishing gear of Lagos, of the Gold Coast Colony, miniature models and specimens of which I had collected, and have presented for show in the Royal International Fisheries Exhibition 1883:—

Fish-traps—called in Popo language "Aja," and in Fantee "Inchabah"—open baskets of split bamboo, secured by tie-tie, of circular form, with two entrances, one at either end, when double, or with one when single. Size varies, but usually made 6 feet long and 2½ feet deep.

These traps are generally placed at the end or approach of a fish passage, whether natural or artificial, over a likely feeding ground. Baskets are, of course, baited with fish, or some farinaceous and oily compound.

Drag-nets—called in Popo language "Aveh," to drag, and in Fantee "Chouee," to draw—made of pineapple or other fibre. Size varies, but usually made 10 feet long, with a breadth of 2½ feet.

These nets are used in shallow fresh water, 3 or 4 feet deep, where they are drawn by men.

Hand-nets, called in the Popo language "Gangdoh," and in Fantee "Ebowaugh." Size as to net and meshes varies. Made of pineapple or other native fibre, also of imported twine; of circular form, usually about 12 feet diameter at mouth. Length of net, 12 or 15 feet; to end of net is affixed what may be called the casting-rope of some five or six fathoms.

This net is universally known in tropical seas and used from canoes, in fresh water, from banks and from the beach. It is thrown by fishermen, by a circular motion of the body from left to right, on the water, where it sinks by means of a weighted outer edge. On drawing up the net, which is allowed to sink as far as the casting-rope will admit, the weighted edge closes, and thus secures any fish over which it may have fallen.

Shrimp basket, made of open bamboo work, secured by tie-tie; of circular shape, tapering from a base varying in diameter from 2 to 4 feet, to a point when a length is reached of 8 or 10 feet, or even more.

These baskets are secured to stake-poles or sticks, laid out in parallel lines of considerable length, of a diameter of 2 or three inches, and of length dependent on depth of water where used. I have met them in water from 3 to 12 feet, even more. The stakes are conveyed by canoes to the site for which they are intended, and there erected by being gradually worked into the bottom by mere manual labour, and it is surprising how firmly they hold. To each stake is secured, with a connecting string of tie-tie of some length, a shrimp basket, which acts as a "hat" to the stake when the tide is going out, as it is so placed to avoid rotting or entanglement. On the flow the basket is lowered into the current. Shrimps, in immense shoals, are carried by the tide into its open mouth, thence to the narrow end, where they are collected in large numbers. From this trap there is no escape. Before the turn, two or three times during the flow, the stakes are visited by the employés or owner, and the baskets cleared.

It is a curious sight to observe of an evening these lines of stakes topped by sea-gulls, all heading to the wind or breeze, when there is one—balmy breezes do not always blow in these regions—which make them their roost for the night.

The catching of shrimps at Lagos represents a very large and extensive industry. The season lies between December and April. The industry includes local consumption and interior trade.

For storage and inland traffic shrimps are smoked, or rather semi-cooked, as follows. A fireplace of mud is built either in or out of doors, and is represented by an open oval-shaped horseshoe mud bank or small wall, the interruption in the shape to continuity acting as the means for draught and for the insertion of fuel, the enclosed area being the receptacle for the fire. Its size is dependent on proportion of industry. Across the open top are laid green supporting sticks, on which rest the fish to be cured, the fire having been first started. The process, which equally applies to fish, so primitive, is really a combined system of roasting and smoking. When sufficiently cured, according to native ideas, they are stowed away in baskets, and kep the fireside, to frustrate as much as possible effects of damp, until finally removed for transport up country to the inland markets. The curing process and the later retail represent industries in the hands almost altogether of women.

At present the ex-king and chiefs of Lagos hold the shrimp-fishing as a monopoly enjoyed before and since the cession in 1861 of their country to Her Majesty. The industry, as far as the catch goes, is worked by their respective retainers, who also benefit by a return from their employers of the privilege to reap the fruits of the catch of a proportionate number of stakes.

Hand-nets, called in Popo language "Anyah," made of fibre; average length of pole, 4 to 5 feet; diameter of net, 1 or 2 feet, and its depth 2 feet; size varies in circumference.

This net corresponds with our English landing-nets, being used for securing fish caught by hook and line.

Hand trawl-net, called in Popo language "Azohara," viz., horn-shaped net; length of supporting pole varies to 20 feet; base of triangle formed by horns about 6 feet wide; depth of net, 8 feet. Size varies. Some tough wood selected; net made of pine-apple or other native fibre, secured by tie-tie.

This net is used as a rule in fresh water from a canoe which is allowed to float with the stream, or may be paddled against it, the pole being immersed to its depth, and the netted end brought up under the banks, especially where grass abounds.

Nets for shrimp or fresh-water shell-fish, called in Popo language "Adada," to lift. Length of handle of net, 6 feet; dimensions of net, 2 feet by 4 feet, and 2 feet deep; size varies.

These nets are for a purpose similar to our landing-nets in England. They are also used either in securing shrimps out of the shrimp-baskets, or under grassy banks of land-sheltered waters for shell-fish.

Matting or grating, called in Popo language "Gba," made of split bamboo, secured by tie-tie.

This matting is very generally used in shallow water, to encircle fishing or good feeding ground covered at high tide, or for encircling floating "grass islands" (really portions of grassy bank eaten and carried away by current or floods), which are first anchored, and which fish make a favourable resort as a feeding-ground; or in making passages into which to allure fish by means of the additional attraction of baited fish-traps at their ends.

The floating islands are not regarded as "flotsam and jetsam." Each can be secured by any person, whose property it then becomes; he stakes it and allows it to remain as a feeding-ground for some weeks, after which he encircles it with bamboo grating as described; the "island" is then cut to pieces and thrown out over the grating which is next gradually contracted so as to bring the fish enclosed, if any, within small compass, when such as may have been entrapped are removed by one of the hand-nets already described. This practice is also applied to grassy banks.

Passages 3 or 4 feet wide are also cut of considerable length into low-lying ground or marshy places; such are filled at the flood, when the entrances are blocked by bamboo grating. On the ebb the passage is free from water, and the fish collected.

Manatee-trap, called in Popo language "Whanh," generally erected in sheltered water 4 to 6 feet deep, and near or on the slope of a river or lagoon bank. Briefly described it is a harpoon of heavy wood tipped with

> iron, suspended by a string connected with a peg slightly secured in the feeding passage, which is immediately under the weapon, from the cross-piece of a supporting wooden framework composed of hard wood and tie-tie.

This trap is generally placed amid rank grass through which a passage has been cleared. About the peg is deposited a small delicate grass known to the natives. During grazing, which is effected on its back, the animal displaces the catch, and meets his fate. The fall of the harpoon does not, although it secures, always kill the animal, which is despatched in such a case by gun-shot.

In the Popo language the manatee is called "Yingbin-yingbin," and in Yoruba "Ese." They are, I have been informed, caught in the dry season, and when the lagoon waters are not full—say, during the first half of the year. Although it is the rule that they reappear with young at the commencement of the rainy season, and retire to the sea on the subsidence of the waters.

The flesh of the manatee is much appreciated by the natives, resembling a combination of veal and pork.

During my stay at Lagos I asked specially that I should be informed when one was caught, and on one Sunday morning, the 4th March last, I was gratified. A manatee had been caught in a drift-seine near Ajedé, in Jebu country, about ten miles from the bar of the Lagos river and up the lagoon. The animal was drowned after entanglement in the meshes of the net. The length was 9 feet, breadth at shoulders 2 feet, girth at thickest part 5 feet 6 inches. At a distance of 3 feet from the end of the tail the girth was 4 feet, breadth of tail 2 feet, length of fin, which was 7 inches wide, was 14 inches; mouth was 8 inches wide, skin about 1¼ inches — no doubt the

Manatus Senegalensis, found in the West African rivers, ranging up to a length of 15 feet—Vogel's "Ajuh" from the Benueh (branch of Niger).

Harpoons, spears, and earthen pots of narrow mouth are also used. The pots are large clay vessels sunk by stones or pieces of broken pots placed inside. They are perforated and baited before they are sunk, when they are placed on the side so as to admit of easy entry of fish. If placed in deep water they are connected by a leading-string to a papyrus stalk or other branch from the overhanging bank. In shallow water the position is staked. Such traps are occasionally visited, which is done as quietly as possible, when the mouths are closed by means of a small calabash in possession of visitor, the contents being thus secured.

The devices as to killing fish when caught are primitive and cruel in our estimate. Canoes are generally supplied with short stout clubs used for pounding the life out of the fish. Large stones are in like manner used. Canoes are so easy to capsize that large fish, when hooked, are allowed to exhaust themselves, or are killed by thrusts of a spear from the canoe.

I remember in Lagos lagoon seeing a large fish hooked and dragged to the side of a one-handed canoe, from which the occupant was engaged in killing his find by repeated rams of the whole handle of his paddle down the throat and stomach of the poor fish.

Drift-nets are resorted to, but chiefly in still sea or fresh water, the suspending ropes being of grass or of some fibre and floated by small calabashes or pieces of bamboo or wood.

An ingenious device for capture resorted to behind Axim is described as follows in the 'To the Gold Coast for Gold':—

"Across a stick planted in the river bed a light piece of bamboo was tied, and at its further extremity was suspended a string carrying fish-hooks. Above these a broad piece of wood, suspended so as to be half in and half out of the water, acted as a float and spindle. Above this again were tied four large shells, so that when a fish is hooked the shells begin to jingle, and the fishermen hid in the bush, immediately rush out and rescue the fish."

Fishing Lines—of Lagos Native manufacture—of pine-apple or other fibre.

Fishermen, as a rule, make their own lines of fibre or of imported thread. Ordinary pieces of stone are used frequently for sinking purposes when lead cannot be had. As anchors, stones are more frequently used than any other device, secured to the canoes by country-made rope of grass or fibre.

On my return to England in April last I bought, as the steamer lay at anchor off the Kroo coast, a canoe containing also a specimen of a native fishing-pot and a specimen of a scoop or bale. Any wooden vessel with a lid may be converted into a fish-pot by the natives. The specimen I secured is nothing more than an American lard or biscuit box.

Native scoops are used for baling out water, and compare with similar devices used by Indians and others elsewhere. Such implements are not invariably resorted to, however, on the West Coast of Africa, where the natives are very dexterous both with hands and feet. I have often seen them baling out a canoe in a most amusing manner with their feet—literally kicking out the water.

The Kroo canoe alluded to is meant to accommodate one, and is a sample of the "dug-out" so common and universally known.

Besides the means for capture previously described the natives of Africa, as elsewhere among aborigines and in tropical parts, resort to vegetable products for the purpose of stupefying and poisoning fish. I may mention the "Toatoa," used in O' Quahao, a country lying to the south-east of the Ashantee kingdom, of which it was, not many years back, a dependency. The juice of this product is described as "so sharp that it wounds the skin on which it falls." The "Efswe" is also used there, which, thrown in a pounded condition into the river, when comparatively still, or into small ponds or pools, is said to stun the fish. Of these I have not, so far, been able to secure complete botanical specimens with a view to their identity or classification. At a certain season of the year, the lagoon waters where they approach the mouths of rivers become quite green from the presence of some class of algæ, and during that time the natives hesitate to eat fresh fish, alleging that there is a danger of being poisoned.

Reference is frequently made to this practice in the works that have been from time to time written on parts of this interesting continent.

Messrs. Capello and Ivens, in their work 'From Benguela to Yacca,' testify, in addition to the abundance of fresh-water fish, to the use of a leguminous plant called, in the vicinity of the river Luando, a branch of the Cuanza, "T'chingando," which, from its poisonous properties, causes vertigo among the fish and ensures their ready capture. They also record that the leaves of the "Ulo," a vegetable bearing a yellow flower, are also greatly used on the Cuango: "thrown into the stream they intoxicate the fish to such a degree that the creatures are easily taken with the hand."

In his Paper on 'Indian Fish and Fishing,' Dr. Francis

Day also made mention of a similar practice, when he described among means of capture "the taking of fish by poisoning pools of water by milk bush, tobacco leaves, Indian hemp, and many poisonous kinds of jungle fruits. This is generally carried on during the dry seasons of the year, when the pools in the rivers are still and hardly any current exists. It is very easy to collect the poisons—throw them into a pool, and await the fish floating intoxicated to the surface. These fish are sold in the markets."

The practice I have alluded to is of such general interest as to persuade me to trouble you with the following particulars of like trees and shrubs used similarly in Africa, details of which I have extracted from Oliver's 'Flora of Tropical Africa.'

Tephrosia Vogelii, a shrub 8 to 10 feet high, its branches woody; ascending, clothed with dense spreading ferruginous or yellowish silky lines: found in Upper Guinea, Sierra Leone, Fernando Po, Princes Island, Nile land—Unyoro, Lower Guinea—Golungo Celto, and Pungo Andongo, Mozambique district—Zambezi, and Zanzibar.

Often used, in fact, cultivated, like the allied *Tephrosia toxicaria* in America, for the purpose of throwing into ponds to stupefy fish, called "Igongo" on the Gaboon.

Milettia ferruginea, a large tree with firm terete ultimate branches clothed with fine short ferruginous silky tomentum. "Berebera" is the Abyssinian name of this handsome tree. The powdered seed is thrown into the water to stupefy fish.

Derris uliginosa, a wide-climbing shrub with firm glabrous terete woody branches. Found in Mozambique district, Zambezi land, banks of the Luabo, and in the Zambezi delta. Stem used, when beaten, as a fish poison, acting rapidly and effectively. Extends through Asia to North Australia, and also occurring in Madagascar.

Randia dumetorum, a stiff spinous shrub. Nile land, Mozambique district; occurs commonly in most parts of India, and extends to Ceylon, Hong Kong, and the Malay Archipelago. *R. Kraussii*, Harv., from Natal, appears to belong to this very variable species. The fruit is said to act as a fish poison.

Morelia Senegalensis, an evergreen shrub of 12 to 30 feet, often arborescent and producing aërial roots. Upper Guinea—Senegambia, Aboh, Sierra Leone, Nupe, Old Calabar river—Nile land, Djurland, Bongo land. Used to intoxicate fish.

In 'The Annals and Magazine of Natural History,' No. 117, Sept. 1867, there is a translation of a most interesting article on Venomous Fishes, by M. Auguste Duméril, brought about by the many instances of poisoning due to the use of certain fishes as food, and, as allusion is made therein to the custom in some countries "to cast noxious plants into the water in order to render the fisheries more rapid and abundant," I venture here to invite my hearers to a reference to the views therein expressed.

It is stated, and condemned, that the Indians bruise the fruits of the *Cocculus suberosus* and many shrubs of the same genus, confounded under the name *Coque du Levant*. "Mix them with a species of crab, and make them into pellets of the size of a cherry, which the animals take with great avidity. The effect is very immediate." Of such a practice it is said by M. Boullay on the subject: "Fish taken with the aid of such a bait putrefy very readily, and if not cooked or prepared immediately may become venomous." Doubt has been thrown on this by M. Duméril, who has advanced that the *Coque du Levant* is frequently employed in India in fisheries whose products are intended for consumption.

I would yet quote from this article: "A further example of the innocuousness of fishes subjected to certain poisonous plants is furnished by M. de Castelnau ('Voy. dans les parties centr. de l'Amér. du Sud.' 1855. Paris, pp. 6 & 7.) An extremely plentiful supply of fishes having been obtained on the great lake near the Rio Sarayacu, in the Missions of the Ucayale, by means of the poison residing in the stems of the Barbasco or Necklace wood (*Jacquinia armillaris*, Linn.), these, after rapidly undergoing the destructive influences of the plant, were eaten without ill effect; and the natives even drank the waters of the lake with impunity."

As a foot note to the above quoted review appears a very useful list, by M. Mouchon, of plants which were then known to be employed as auxiliaries in the capture of fishes, subdivided under the headings: (1), Plants that are baneful in effect upon the human species, particularly if the precautions be not taken of well clearing and scraping the fish before preparing it for food; (2), Plants that are not hurtful to man. The list includes some orders peculiar to tropical Africa, and does not embrace the plants which I have already mentioned, which will explain why I dwell so much on the article of Venomous Fishes, my object being to endeavour to help those, who may help their countrymen—I mean the more enlightened and educated in West Africa—in the cessation or avoidance of practices so much to be condemned, and with such a doubtful issue, and to warn them that such practices are liable also seriously to so affect fish as to bring about, even after-curing, sad results.

Nothing can be so good or wholesome, in my experience, as fresh-fish diet with nutritious accompaniments, and I have had visible proofs of the fact in the appearance of the coast people as compared with those of the interior, who are almost altogether dependent on, and prefer, unwholesome and unsound fish.

I can here remember what fine-looking people the Katanus—to be referred to later—are in spite of the malarious place in which they live ; they were, on the whole, a fresh fish-eating people, having plenty of open air exercise and abundance of bathing.

I am given to understand that no special diseases show themselves among the coast fishing population. I may except the greater liability to craw-craw and Guinea worm on the part of those engaged in fresh and brackish water, owing to constant wading and passing through grass. On the contrary the sea fishermen are about the healthiest class, as elsewhere, from their healthy occupation, comparative cleanliness, in the way of abundant sea-bathing, fresh fish-food, and the sale of surplus catch resulting in enabling them to supply themselves with other forms of diet. Their suffering from exposure is nil ; then it will be remembered that natives are very fond of oiling their bodies, which would greatly assist in keeping up their temperature, and then do away with risk of chill, so promotive of fever and rheumatism in Africa.

From the nature and general condition of the fish used as food, as also in consequence of the preference held for fish in a state of semi-decomposition rather than when fresh and wholesome, one is induced to look around for the issue of some ill consequence. It is not within my intention or scope to advance any theories, but I may repeat that the natives of West Africa suffer, besides ordinarily, much from elephantiasis, leprosy, yaws, cutaneous diseases, and ulcerations of a low order. The primitive and defective system of curing, apart from the semi-putrid condition of the fish food, must lose, in such a climate, its efficacy, and thus it may be presumed that deleterious effects can be traced to its imperfect or bad preservation, such as, say, of the "herring," which the natives on the coast and in the interior principally consume.

Dr. Clarke, who was Colonial Surgeon on the Gold Coast, and surgeon to the natives, in his medical report for 1858 has dwelt on the food question as follows :—

> "Elephantiasis and Lepra (leprosy) in all its hideous forms prevail. The natives suppose it may be induced by drinking excessively of palm wine which has been mixed with the juice of the bamboo; but it may, with much greater reason, be accounted for by an excess of fish diet. A very large proportion of those who were treated at the dispensary were afflicted with scrofulous disease, either in the form of ulcerations of the skin, glandular swellings of the neck, or disease of the bones. The cause of its prevalence, I feel assured, is clearly traceable to the crowded, ill-ventilated and generally foul condition of their houses and sleeping places. The walls of most of their dwellings are formed of clay, which are rarely if ever whitewashed. Most of the rooms are miserably small, damp, dark, and badly ventilated, especially those devoted to sleep. In their sleeping places the poorer classes, and many persons in better circumstances, keep all the dirty clothing not in wear either about their beds or hanging from the wall, scraps of food and putrid fish being strewed about or collected in corners. I have observed that the mortality among the natives is greatest at the commencement and termination of the rainy season, and hepatitis, diarrhœa, and dysentery are then most prevalent, these diseases being then frequently brought on by eating new corn, ground nuts, casada, and yams before they are sufficiently dry. The food of the mass chiefly consists of vegetables and fruits with fresh fish and dried fish in excess, often so highly ammoniacal as to be commonly known under the name of 'stink fish,' with land snails and land and sea-crabs. But their principal dish is composed of fish, and, when they have the means, of fish, fowl, or meat, stewed

singly or together: palm-oil, freshly expressed from the nut, being always an important ingredient in it. This stew is made piquant and wholesome by the addition of salt, bitter tomatoes or ocroes, shallots, or, as substitute for the latter, the dried bark of a tree called 'Edooah Ahyew' (which resembles the onion in flavour and taste), and abundance of red peppers."

"Animal food is, however, seldom eaten, and even milk is rarely used by them."

Dr. Clarke has been supported later by the experience of Colonial Surgeon Jones, from whose report in the year 1867 I extract as follows:—

"One of the most frequent complaints of the native population is constipation, which I attribute to the fact of their living all the year round on 'Cankey' and semi-rotten fish, and to the fact of these people being restricted to this miserable diet I think in a great measure is due the frequency with which they suffer from ulcers of the extremities, particularly of a low, indolent character, which are very difficult to heal."

I have not met in the Colony with any views since expressed as opposed to such opinions, but the conclusions of these gentlemen were no doubt based on the large consumption of what has been already described as stinking fish, on which the people have mainly to rely (and which they seem to prefer at any season) during the rough weather on the coast of Africa, occurring in the months of May, June, July, and August.

Medical experience of note elsewhere, such as that of Dr. Gavin Milroy in the West Indies, accords with the conclusions of Messrs. Clarke and Jones on the subject of the baneful effects innutritious and semi-putrid fish food must have on the human system.

I can recall here (I trust my memory serves me right) the chief reasons I got from a medical man in Norway for the existence on its West Coast of so much leprosy, viz., bad food—principally fish—exposure, scanty clothing, want of cleanliness. Dr. Gavin Milroy, in a conversation I had with him, supported these reasons, explaining further that, on inquiry on the subject, he was informed that some Norwegians of the lower orders prefer tainted to fresh fish.

Again, on the contrary, in the discussion of a case of recovery from leprosy, by Mr. Jonathan Hutchinson, reported in the 'Lancet,' Feb. 15th, 1879, it is reported that Sir Joseph Fayrer said that if "the eating of putrid and decomposing fish were a cause of leprosy, then the whole of the inhabitants of British Burmah and the Malayan peninsula ought to suffer from leprosy, for that was their most favoured food. But leprosy was almost unknown in these countries; whereas it abounds in the Himalayas, where, as Mr. Macnamara had stated, fish eating did not and could not prevail. . . . Certainly in India leprosy was not due to fish diet."

Whether the disease be due to fish eating, its importation, surrounding circumstances of social condition, exposure, innutritious diet, malarial prevalence, seaside localities, the bacillus, its introduction into the system through the medium of putrid food, or by mosquito bite, is beyond my unprofessional power to advance; in fact it would be presumptuous on my part to even risk an opinion. The question seems yet a moot one, and, with reference to the disease, Dr. Erasmus Wilson has advanced, I think, in 1881, that the question of cause "must still remain unsettled until further information is obtainable. A specific form of bacillus has recently been found in leprosy, the lymphatics being believed to be the channels of infection."

Recent researches, according to Drs. Fox in the 'Epitome of Skin Diseases,' point in the direction of the existence of a special bacterium (*Bacillus lepræ*).

"To be or not to be, that is the question."

Here offers a grand opening for display of West African medical talent.

I am not prepared to dwell further on this part of my Paper, beyond recording that it has not, unfortunately, been my experience to find extended, with exceptions, to special diseases and their causes that attention and interest which science and humanity dictate.

It is interesting to note how curious it is that red pepper (chillis, the fruit of *Capsicum annuum*) is so generally used in malarial Africa and in other tropical countries. In this use West Africa stands prominent. It may be concluded that people in such countries are always more or less below par, especially in Africa (for such is my experience), and that stimulant is deemed needful, and resorted to. The pepper affords a powerful stimulant, and promotes further the digestion—whether with an ultimate satisfactory issue or not is another question—in countries such as West Africa, where the digestive power becomes considerably impaired.

Salt forms an essential factor to the health and contentment of the natives, and is only somewhat devoted towards the curing of fish, being principally used as a condiment. Odd to say, it is largely imported into West Africa, its manufacture from salt water by the natives receiving but scanty attention. Beyond a matter of interest and of astonishment, the mention of this industry, as compared with salt importation, is scarcely worthy of notice.

For the purpose of curing fish, salt is only used on the coast, and even there not altogether, when the catch is exceptionally plentiful, and the scarce season has to be provided for. Salt-cured fish during the "scarce season," is used on the coast-line, finds its way into the interior, but is not appreciated in either locality as is "stinking fish." In fact, I have satisfied myself that the aborigines really prefer the latter where a choice was allowed or could be made: and even where fresh is used, there is, if it be available, some of the other mixed up with it, for the purpose of "flavouring."

With reference to shrimp curing, I would continue by remarking that the same system applies to fish, more particularly to the herring, which abounds towards the end of the rainy season. The catch is at times so great that the people really do not take the trouble to attempt, even in their primitive fashion, to cure what they can, but after satisfying what they may estimate as their wants, throw away the surplus. Salt curing, I repeat, is somewhat resorted to, as is also "smoking," but both systems are imperfect, and suffice as to efficiency but for a time, after which the fish becomes semi-rotten. So pronounced and offensive is the smell arising from its general condition that fresh-cured fish is commonly spoken of as "stinking fish." Its stench will be universally acknowledged by those who know West Africa. I do not mean to imply that it is always bad, but my own travels in those parts support me when I say that I have seen carriers and interior people partaking of fish food unfit even for a dog.

Again, on the modes of curing employed by the Bongos, Schweinfurth relates—

> "There are two methods which the Bongo employ to preserve the flesh of their fish. Table salt they cannot get, but they substitute what they obtain from ashes. They cut the fish through lengthwise, simply expose it to be dried in the sun, and afterwards hang it up to be fumigated in the clouds of smoke which fill their

huts. Another way is to cut the fish up and dry it, and then to pound it all up in mortars until it is reduced to a jelly, which is rolled into balls about the size of the fist. These, with their high flavour, form a favourite ingredient in soups and sauces which are certainly wanting in all other aromatic condiments."

The sale of salt acts well as a barometer of the state of the inter-tribal relations of the interior. It is often used as currency or means of barter, showing its importance. With petty warfare proceeding in the interior—a normal condition of things—and with roads blocked, or rather trade routes obstructed, as a sequence, the trade in this much-coveted article is small as compared with its disposal in peaceful times. It can then be judged why the curing by salt of the interior fresh-water fish is out of the question, as also why, when fresh fish is not to be had, "stinking fish" becomes the staple commodity for the daily meal.

Here follows the value of salt imported into the Gold Coast Colony during the four years given :—

Year.	Value of salt imported. Gold Coast.	Value of salt imported. Lagos.
	£	£
1878	1670 13 1	4250 8 7
1879	3441 12 10	2840 19 1
1880	4079 4 6	5439 18 9
1881	1682 7 3	8037 2 5

Fiscal conditions on imports differ in our West African Possessions: some articles of food are allowed to enter free, whereas on others an *ad valorem* rate and salt-tax are levied.

Such impositions cannot at present be said to have the same effect as it is advanced the salt-tax has had in India, as to fish-curing, for such is the depravity of the human taste in West Africa—the inheritance of birth and training—as elsewhere, that at times, and most frequently, semi-putrid fish is preferred to any other. In my statement I am supported by the fact that there is no gradual increase in the taste of the people for foreign-cured fish.

In such a depraved taste the Negro is not an exception, for of Balasore, in Bengal—I here extract from Dr. Day's paper previously referred to—it is stated by the Collector that—

> "Fish sold in the markets is so stale that no European would touch it, and most of it is putrid . . . The people in this district do not salt their fish, they dry it in the sun, and eat it when it is quite putrid. They like it in this way, and there is no reason why they should be interfered with."

Oysters.

Edible oysters are found in beds, on the rocks running out into the sea, which are uncovered at low tide, and on trees (mangrove). The trade in oysters is large, but chiefly, in fact altogether, confined to the coast, as its delicate nature, even when cured as the natives affect, does not admit of long keep.

The trees on which oysters are usually to be found in the tropics are of the mangrove family, the nature of which, with their aërial roots, admits of their growth in the flow of the oyster spat, which is thus at times in part intercepted, adheres, and develops into what is commonly spoken of as the tree-oyster. Mangrove oysters are not as much sought after as bed or rock oysters, although they are collected for the sake of their shells, for the purpose of conversion into lime.

Bed-oysters are more extensively sought after. A solitary canoe at anchor over oyster-beds may be seen at times with no occupant. He has dived with his basket, and grabs in the mud (so long as his breath will allow him to remain under) for his prey, until by such repeated efforts he succeeds in filling his canoe. Women are usually the buyers and subsequent retailers of such commodity. Rarely, except for European tastes, oysters are sold open, but in bulk with shell on. Such as are not disposed of fresh are cured similarly as are shrimps and fish.

The oyster season, although the mollusc may be taken at any time, may be viewed to extend, as far as the Gold Coast colony goes, over six months or so of each year, during the rainy season. Oyster collectors make yearly presents to the fetish-priests, to invoke and propitiate the god of fish.

There is a certain danger associated with this industry, for it has been known that persons concerned in the same have fallen victims to sharks and crocodiles. The collection of the raw material can be followed out by any man or woman. Odd to say, among the Yorubas, he who follows the oyster industry is considered as of the lowest grade of society. In the past such a man would be denied marriage in a family of position above his social estimate. Women go in for the collection of mangrove-oysters.

In West Africa man has competitors as fish destroyers, such as the crocodile, shark, ray, otter, porpoise, water snake, turtle, tortoise, birds, etc.

The West African rivers at their mouths, and up a certain distance, abound in sharks, which are the terror of the natives. They are found in greater numbers at some places as compared with others, but so far as I know their catch is not profitably, if at all, followed up. Sharks are eaten in Western Africa, as in many other tropical countries; and when consumption at the time is not equal to available quantity, the surplus is sun-dried or smoked, being treated as are herrings and shrimps.

" Scale of dragon, tooth of wolf ;
Witches, mummy ; maw, and gulf,
Of the ravin'd salt-sea shark."

Lagos bar is noted as a favourable resort for this sea monster; and of the river St. John's, in Liberia, Burton speaks that "it owns a bar as infamous as that of Lagos for surf and sharks."

Of the Dahomean coast, the beach has been often unworkable as regards landing and loading, as the canoe-men (Fantees or Accras, commonly known as "Minas"), whenever (and it is of frequent occurrence) one of them falls a victim to a shark, have absconded from time to time in abject terror. From Cootenoo, for instance, it is not an unusual thing to have at Lagos runaway crews amounting to sixty or eighty men who have escaped by the beach. The same has happened frequently in the other direction from Whydah. I was led to believe early this year, before I left Africa, that these means of escape from their employers had been cut off by Dahomean guards at either end. Here the French commercial houses have tried with some success the drift-net; they have also used dynamite devices for the promotion of confidence among their employés, rather than the effective system, if not of gradual clearance, at least of considerable thinning.

In view of the field presented, it is astonishing why sharks are not put to use as in Norway, where they are captured for their livers ; or as in India and China, where the fins form a very important article in trade, the people of the former country preparing from them, in addition to other extracts, gelatine.

In Norway some of the fish furnish livers weighing only from 25 to 30 lbs., while from others livers of 220 to 450 lbs. are obtained.

If one can conjecture from the effect a malarial climate, especially that of West Africa, has on the human liver, and can deduce that the shark is similarly affected—at least the unacclimatised itinerant—a good and big find might be anticipated.

It is said of Norway that the carcasses of sharks have been of late years brought ashore for the purpose of being manufactured into manure or guano. The mode of capture there is by means of line and hook baited with seal blubber or some other rancid and strong-smelling bait. The annual yield from this fishery amounts to from 8000 to 10,000 barrels of livers, worth 150,000 gulden. The oil of the shark obtained by steam heating is said to be extremely fine, and is used for purposes of illumination.

I am reminded here of the remark of one of my boatmen at Lagos (a Krooboy), in answer to my questioning him. I may preface what I am going to convey by saying that Krooboys view sharks as their natural enemy and legitimate game. His opinion of this monster was that "he be debil man. He good for chop (food). He chop Krooboy, and Krooboy chop him"—mutual obligations of a curious nature.

In support of the value of a shark fin industry I embody as follows:—

"At Kurrachee a large fishery is practised. Dr. Buist, writing in 1850, states that there are 15 large boats, with crews of 12 men each, constantly employed in this pursuit; that the value of the fins sent to the market varies from 15,000 to 18,000 rupees: that one boat will sometimes capture at a draught as many as one hundred sharks of various sizes; and that the total number of sharks captured during the year amounts probably to not less than 40,000. Large quantities are imported from the African coast and the Arabian Gulf, and various parts on the coasts of

India. In the years 1845–46, 8770 cwt. of sharks' fins were exported from Bombay to China.

Rays—like to the *Aetobatis*—known in Fantee as *Tantray*, are to be plentifully found on the West Coast of Africa, in the Gulf of Guinea, towards the end of the year, and in company with shoals of small fish. They are at times caught in the hand-nets. Natives are much afraid of the attacks from this fish, as the caudal spine has been found to be poisonous, and has inflicted wounds which have proved fatal. Such wounds can be, it is said, however, successfully treated, when handled in time, by the natives, who use for the purpose the powdered caudal spine of like fish, mixed, with certain leaves and herbs.

I have with me the caudal spine of a small sting-ray, which was removed from the side of a fisherman of Quittah, Gold Coast. In lifting the fish into the canoe, it struck him, the spine remaining in the wound. Six hours later the man was seen by one of the Colonial surgeons, when the wound presented a very discoloured, unhealthy appearance. The man died six days later from empyœma caused by the wound.

Writing of the poison organs of certain fish, Dr. Günther has stated, "That such organs are found in the sting-rays, the tail of which is armed with one or more powerful barbed spines. Although they lack a special organ secreting poison, or a canal in or on the spine by which the venomous fluid is conducted, the symptoms caused by a wound from the spine of a sting-ray are such as cannot be accounted for, merely by the mechanical laceration, the pain being intense, and the subsequent inflammation and swelling of the wounded part terminating not rarely in gangrene." This fish is cured in the manner already described, is sold in the markets, and is considered a great delicacy. The tail is used as a whip.

The crocodile, known locally in some places as the "cayman," and commonly called "alligator," deserves a passing notice. Most of the West African rivers and lagoons are infested with them; they are worshipped fetishly as a god, and are the terror of many a village bordering on their watery haunts.

Children and women have been often carried off, and many a person has been maimed, especially in the early morning, as they visit rivers for water. On such occasions, while women are filling their calabashes or earthen pots, one of the number is often employed to frighten off the monster by throwing large stones into the water beyond their dipping companions.

The skin of the crocodile is converted into caps and bags by the natives, and the flesh is smoked and eaten.

"Eat a crocodile!"

Stories are heard of the game "catch-catch" between this monster and persons, as also of the latter being chased on land by the former.

It is told of a fresh-water pond at Dix Cove, Gold Coast Colony, in which there was a crocodile of some twelve feet long, which always appeared at the bank at the call from the "Fetishmen" for its meal of fowl.

An amusing story has been told me in connection with the doings of a crocodile. It is no uncommon thing for one of them to transfer its habitat from the main lagoon to some inland pool or lake at a distance. On one such journey a crocodile mistook the route, and mounted a bamboo fence that had partially fallen, thus affording a convenient camp for observation, we shall say. This lean-to fence partly enclosed a compound, in which at the time there happened to be a policeman, who, inspired with the proper sense of his duty, rushed at the creaking fence, which he embraced, expecting to find a would-be burglar, instead of our friend the crocodile!

I suppose a crocodile, as any other creature, can refer to a constable to be put right on a question of locality!

It is commonly believed by some tribes that the "Fetishman," when he wants to do injury to a family, can convert himself into a crocodile, and as such perpetrate his credited evil intent by maiming or carrying off—

> "Beguiled as the mournful crocodile
> With sorrow snares relenting travellers."

Edible turtle are found in abundance, but are not, such is my individual experience, as a rule, in good condition, being poor. They are caught in the circular hand-nets and speared, but are generally captured on the beach, where they come to lay their eggs. The natives on moonlight nights watch for them, cut off their retreat, and, turning them over on their backs, thus secure them.

The Ascension Lakes, supplied, I understand, as above, are well known in the West and South African squadron, providing as they do a rich and appreciated out-put. Why could not some of the many "salt ponds"* adjacent to the African coast line be similarly used as rearing waters, and another industry be developed therefrom, although I doubt the suitability of turtle soup as a tropical diet in a malarial country where the "fitful liver" has to be gently treated, and we have no aldermen.

Fishing Towns and Villages.

Fishing towns and villages, often well marked by the groves of cocoa-nut trees that surround them, are to be found scattered along the sea-coast, and on the banks of rivers or of inland waters; some permanently occupied, others only temporary residences of convenience in pursuit of calling. Alongside these, sometimes at a distance, the fishing-canoes are hauled up and picketed.

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* Brackish inlets or salt-water lakes.

Lake Dwellings.

Swiss lake dwellings and Scotch crannogs of the past have afforded, especially of late, considerable attraction, and on the subject, by way of comparative interest in like structures of the present time, I am reminded of the lake dwellings of certain tribes who surround or live on the sheet of water known as the Denham waters, lying behind the Dahomean sea-board, and the rivers that flow into it. As the male occupants are mainly fishermen, or fishermen and farmers combined, I do not hesitate to include in this paper some notes of my experience of them.

During my administrations of the Government of Lagos I paid several visits to these waters—in fact have steamed through the water streets of the towns and villages to which I refer—and had thus the opportunity of observing for myself the modes of life on which I would ask permission to briefly dwell. Interest in the subject will be perhaps enhanced when I mention that these waters have, I believe, given rise to diplomatic correspondence in consequence of the acceptance by the French of the protectorate of the kingdom of Porto Novo.

These tribes are the Kátanus, Esos, and Whemians, who have not fishing resorts erected for convenience, but occupy large native villages and towns built entirely out and over the water.

The question naturally suggests itself, what is the cause for such a resort? It is explained when I say that these tribes once formed part of the old kingdom of Dahomey, which was in the past split up by inter-tribal wars, and the weak were not driven to the wall, but literally into the water, where protection was sought from their more powerful fellow-countrymen—viz., from the ancestors of the present occupants of the Dahomean kingdom—the protection being ensured from a knowledge of the fact that it has been for some time conveniently contrary to the Dahomean fetish to cross water, at least in canoes.

Such towns or villages have each a floating population, varying, I may estimate, from two or three hundred souls to as many thousands.

The people are fine and healthy, and, as a rule, are very free from disease. I may say they suffer from "craw-craw" and guinea worm.

Their houses are built upon piles or stout straight branches of hard wood, of some 3 to 6 inches diameter, which are secured as supports by being worked under manual labour from canoes into the bottom some 3 or 4 feet. The upper ends are then secured by crosspieces of like nature, on which is worked a bamboo flooring two-thirds or a half of which is covered in by a house, the uprights of which are fixed first, and secured below the platform to the supporting piles. The roof frame is next made on the platform, then covered with grass or bamboo leaves and raised to its position, when it is secured by the tie. The remaining portion of flooring is used as a verandah, or rest aloft and is sometimes covered in or not, according to the wish of the owner. In the construction no nails are used.

Houses are in shape rectangular, sometimes conical, having in the latter case the appearance of floating beehives of large proportions.

These people are not only fishermen, but are pastoral, especially the Whemians; and their relative monetary positions, and consequent social status, may be guessed by the general appearance of their houses, and by the stand of cattle to be seen in the pens adjoining their houses, built on piles over the water, as are the dwellings. The absence or shallowness of the water at some sites in the dry season admits of the cattle being allowed to wander on *terra firma*, in fact of the erection and repairs of dwelling houses; but fodder has to be brought by canoe to the less fortunate creatures that have to eke out an existence in such pens as are always surrounded by water, until such time as they are tethered and transported by canoe to the butcher.

The length of the piles depends on depth of water, and on the probable rise in the rainy season. I have seen houses built over water some two to three fathoms deep. Should there happen to be a higher rise than allowed for, which at times happens, when even the platform is covered, a temporary flooring is made in the roof, with a hole in its thatch as a door, over which the people have to reside until the water has subsided.

Habit, associated with still-existing dread, leans them to a preference of a continuance of such occupations, although the people cultivate farms and make oil on the adjoining lands.

Domestic animals among them are pigs, goats, sheep, cattle, dogs, etc.

The men fish, farm, and trade, while the women attend to the live stock and attend markets, paddling their own way; they also fish.

The fishing gear is similar to what I have already described.

Inter-tribal fighting, whether for offence or defence, has been conducted from canoes capable of holding two or three persons, their weapons being guns, harpoons, spears, and clubs. So uncertain are they of safety, and so apprehensive of danger, that they keep, when travelling, secured against the sides of the canoes, guns and a quantity of ammunition. Their beds are similar to what is usually enjoyed even on land, viz., a reed or fibre mat, on the bare floor.

Polygamy exists, but wives and children live in separate houses from husbands. On invitation a particular wife will join her husband, and on such occasion, generally at night, paddle her own canoe to him, and convey—the rule—his evening meal.

Having now dealt as far as space will allow me with the coast line, I will refer to the islands.

Canary Islands.

I know of only two systematically and profitably pursued industries on this coast to which I would make allusion in this Paper, viz., the "cod and bream" fishery of the Canaries, and the whaling of the African Atlantic.

Of the former, the fishing-ground may be considered as lying between the Canaries, Cape Verde islands, and like latitudes on the African coast, or from 14° or 15° to 32° or 33° N. lat., the favourite site being between the island of Fuerto Ventura, Cape Bojador, and Cape Blanco.

Much attention has of late been directed to these waters, and a source of considerable wealth no doubt presents itself. It has been advanced—an open question—that there is more fish between these islands than around the coasts of Newfoundland. M. Berthelot, in a work on the Canary fishery, came to the conclusion that the quantity of fish caught by one man in the Canaries is equal to that caught by twenty-six in Newfoundland. These advances furnish just ground for argument into which I do not intend to enter here.

The class of vessel employed is represented by the fore-and-aft schooner of varying size, from 20 to 50 tons, with a crew each of from 18 to 40 men and boys. In the years 1879 and 1880, the craft employed in this trade numbered 31 vessels, with a total of 913 tons, of which 16 belonged to the island of Grand Canary, and 15 to the island of Lanzarote.

Fishing-boats work all the year; but the season for the African coasts is given as from April to September, distinct, it would seem, from the island season mentioned as between September and March.

Fish are caught by hook, but from Grand Canary nets are also used. A system prevails of trailing a number of hooks attached to lines run out at right angles to the vessel, representing a means of capture that shows at times a good return.

The curing is done by salting, which is effected on board the schooners; but the imperfect process has been advanced as a reason why there has not been a greater development of the industry, and more appreciation of the cured fish. Another consequent industry has sprung up, viz., schooner-building in the island of Grand Canary.

The following is a list extracted from Consul Dundas' report, in 1877, on these islands, of the principal fish, ranging in weight from 15 lbs. to 65 lbs. each, included in what I may call the Grand Canary and Lanzarote fish industry:—

"Cherna or Cherne (*Perca cernua*), similar to cod, and considered inferior to Newfoundland cod.

Sama (*Serranus acutirostris*), very common, large excellent fish ; fished for in the arm of the sea that separates Grand Canary from the coast of Africa.

Sama Dorada (*Dentex vulgaris*).

Sama Grande (*Chrysophrys cæruleosticta*), weight rarely passes 45 lbs.

Sama (*Dentex filosus* and the *Pagrus auriga*).

Corbina (*Corvina nigra*), weight 30 lbs. to 45 lbs. ; fished for in the channel separating the archipelago of the Canaries from the African coast.

Bosinegro (*Pagrus vulgaris*).

Abadejo (*Serranus fuscus*).

Pez-rey (*Temnodon saltator*), average weight 20 lbs. ; very plentiful about Fuerte Ventura.

Rubio (*Trigla lineata*).

There is another species of Abadejo, which at Lanzarote and Grand Canary goes by the name of Abriote, of which the flesh is said to be excellent. It is met with in immense numbers on the African coast, and attains a large size, weighing as much as 30 lbs. Finally, a fish locally called Tasarte, said to be very like salmon. These are the kinds caught in greatest abundance by the men employed in the craft."

Large supplies of salt fish are exported for Cuba, but statistics are not obtainable as to quantity or value.

Consul Dundas has stated that ordinarily 40 tons may be loaded in three days. Other estimates give the catch per vessel per diem at from 15 to 39 quintals of 200 lbs. each.

The average amount of fish caught during 1880 by the vessels of Grand Canary, has been returned as 1,414,000 kilos., of which 1,122,000 kilos. were salted :—

Value of fish	£33,208
„ nets used	£5,292
„ 22 vessels with 740 tons	£14,250

with 1,190 as the number of men employed in the industry.

Within 1880 and 1881 a French company has been sending steamers to Cape Blanco to purchase fish from the island vessels, which was conveyed for sale fresh to Marseilles. I am led to believe that this enterprise has failed, the refrigerating process not proving equal to the want. It has been said that the fish, on arrival at Marseilles, often proved unfit for food, and when even fit, did not admit of farther transport, both on account of condition and expense.

A considerable number of American ships, nearly all whalers, resort to Grand Canary for the purpose of obtaining supplies of provisions, water, and coal. It is, besides, known that there is often a whale-run in the vicinity of these islands, especially between Teneriffe and Grand Canary, and that from Santa Cruz (capital of former) anchorage, the American whalers often pursue, within one or two days' sail; indeed are at times engaged in whale fishery within sight of the islands.

It will be in place here to mention, that in 1880 there were 111 vessels engaged in the whale-fishing on the North and South Atlantic grounds, whence oil and bone were taken worth 908,771 dollars. Mr. Brown Goode has, however, stated that, "the whale fishery has of late years greatly decreased in value, owing to the introduction of mineral oils, and the great diminution in the number of whales—due to over fishing."

Some further particulars on this industry will be found in my remarks on St. Helena.

The development of a large fish industry under the name of the "Canario-African Fisheries Company," began some two and a-half years ago, and conducted by the energy and experience of Signor Silva de Ferro, proceeds from the Island of Gracioza to the north of Lanzarote of the Canaries. The working fleet is composed of two steamers of 50 tons each, engaged in transporting clean fish from the banks to Gracioza at eighty tons a week; six schooners of some 60 or 70 tons each, and ten sea-fishing boats (the schooners and boats conduct the fishing on the banks).

The industry is pursued all the year round, and carried on south of Canaries along the African coast, as far as Cape Blanco, viz., between 29° and 20° N. lat. Pelagic and shore fish are most plentiful, and offer here as elsewhere on this coast a field for an extended industry.

Signor Ferro has assured me, that within fifteen minutes he had on one occasion secured from the African shore 20 tons of herrings by means of a seine of 90 fathoms in length, let down by one small boat; further, he has seen one of his Masters catch in 32 fathoms of water—depth at which fishing for big fish is generally conducted—110 large fish within two hours.

Within four months, 600 tons of dry and pickled fish have been exported from Gracioza, where the air is said to be so dry that the cleaning, pickling, and drying process only requires ten days, when the fish, sometimes two or three inches thick in the meat, is ready for export. The directions of export have been to Spain, Cuba, South America, and Fernando Po, the transport being effected by sailing vessels, and steamers.

Signor Ferro can load now in ten days what used to take formerly two months. This saving of time is due to the use of herring—so easily and generally obtained—as bait. Formerly the Canary fishermen, who are described as so nservative as not to have made any progress, at least, in this industry, for centuries, had to purchase the octopus —to be found only at certain places—from the Moors on the African coast, and with it fish for "chopa," a sea-bream which represented their bait for the large fish.

As an encouragement, considerable land concessions on the Gracioza Island were made by the Spanish Government, in the first instance to Signor Ferro, who has transferred his rights to the above-named company, which command the whole of one side of the harbour lying between Gracioza and Lanzarote, represented as the only safe and commodious anchorage amongst the islands or on the neighbouring African coast, before River Ouro, where the peninsula forming this harbour of refuge for fishing craft has been purchased in the Spanish interest from the Moors by the Company.

It has been represented to me that nine-tenths of the inhabitants of the Canaries and Cape Verde, live on fish with their toasted corn or flour—"Gofio"—and on my inquiries as to the existence of leprosy, I am informed that the "fishermen are very subject to sores and ulcers of a very permanent description."

Red coral and sponge are to be found around Gracioza.

In view of the opening presented for the growth of a fish-oil, and guano trade, it does seem surprising to find guano, and chemicals for the manufacture of guano, among the imports into the Canaries. What has been in the past done, or is being done, with its surplus fish or its offal ?

I am glad to find that the eyes of the Canario-African Fisheries Company have been opened to a similar view as have mine, and that fish-oil and guano industries are likely to grow up.

With reference to the other Spanish Possessions, Fernando, Annobon, Elobey, Coresco, San Juan, etc., with a given population of 35,000, the natives follow a like primitive fish industry as is to be found elsewhere among their fellow-countrymen along the coast.

It becomes here my duty to warn speculators against the Canary Quarantine Laws, which in their operation are very fitful. They say that, on one occasion, because cholera was in Egypt or in India, the authorities of the Islands deemed it prudent to enforce their sanitary precautions against their own fishing vessels, because they had been engaged on the West African banks.

There is also a very good story told in connection with this subject, which must have got about also when some Asiatic epidemic was more heard of than usual.

While the channel fleet of six ships lay once at Grand Canary, a mail steamer arrived from the West Coast of Africa. The Admiral of the Fleet caused her to be visited, with a view to securing a grey parrot. The master of the steamer sent back word to the effect that, while he was sorry he had no parrots for sale, yet, if the Admiral would accept, he would be happy to give him one. The latter was condescending, and caused to be sent the "dingy" for the parrot. As the steamer had not at the time received "pratique," the boat was taken under her bows, and the parrot in cage was lowered by a rope into the stern-sheets of the "dingy." At the moment, which proved afterwards awkward, the local official who was keeping guard around the mail steamer appeared, and, on inquiry into the case, declared that if the parrot were taken to the flagship the squadron would be placed in quarantine, and if even the parrot were returned to the steamer, the result would be the same when the "dingy" got back to her station.

The parrot was eventually taken alongside the flagship, the guard-boat escorting the dingy ; and on the matter being reported to the Admiral, he ordered H.M.S. "Dingy" to be anchored in the line in her station as seventh ship, and, on this being done, the fleet were informed that the dingy had taken Fleet No. 7 ; next that No. 7 was in quarantine, and that the remaining ships were not to communicate with her.

So the poor "dingy," with her crew, inclusive of parrot, remained anchored in discomfort, but in importance, while a large yellow flag floated over her bows, until—well, nothing further has been logged.

Cape Verde Islands.

According to the census of 1878, the Cape Verde islands, ten in number, situated about 320 miles from the coast of Africa, contained a population of 99,318. In 1881 the British subjects were 89.

The growing importance of St. Vincent as a coaling station is well known.

Although the manufacture of salt forms an important industry in some of the islands, yet the absence of protected anchorages has no doubt interfered with the development of a fish industry. From the remarks on the Canaries it will be gathered that the fishing grounds of the Cape Verde islands are worked by vessels of the former archipelago.

It is stated of the coral, that although "considerable quantities of good quality are found in the neighbourhood of the islands, nevertheless the Portuguese inhabitants appear to take but little interest in this remunerative business, and the fisheries are entirely conducted by Italian and Spanish firms."

The value of coral obtained in 1879 equalled 18,061,840 reis, viz., £180,618.

To the other Portuguese possessions on this coast, viz., at Senegambia and Bissao, with a population (1873) of 9282, Princes and St. Thomas Islands with a population (1879) of 20,931, Ajuda (Whydah) with a population (1873) of 4500, and Angola, Ambriz, Benguela, and Mossamedes, with an estimated people of 2,000,000, the allusion *in re* the Cape Verdes to the non-existence of a developed fish industry beyond the primitive native calling will, I am led to believe, equally apply.

St. Helena.

The population of St. Helena has been returned for 1881 as 5,059, of whom 4,511 are given as natives. There were 171 boatmen and fishermen.

In Mellis's "St. Helena" will be found the following description of the fishermen:—

> "Those men who prefer exclusively to follow the noble calling of fishermen number about 80 or 90, but they are a class who through years past have lived away from civilization: their wives and children occupying small miserable huts, or nearly inaccessible caves along the rocky shores, where they are altogether far removed, partly through their occupation, and partly through their long-acquired habits of indolence and demoralisation, from any beneficial influences. The men themselves, although there are some few exceptions, are for the most part satisfied to bring in just sufficient fish as will afford food and obtain a supply of Cape wine for a few days, when, after indulging in the excess in the latter, and recovering from their half stupefied state, they proceed out again for the same purpose."

There are no fresh-water fishes indigenous to the due, no doubt, to its volcanic nature. Albecore, barracouta and mackerel constitute the chief food of the population.

The fish field, which is represented as bountiful, is regarded with indifference. Although the fishermen have comparatively no bad weather to encounter, there is really no system of fishing or fishing trade. "Beyond a very partial and scanty contribution to the supply of food for the inhabitants, no use," according to the above-quoted author, "is made of the fish, or profits derived from it."

St. Helena and its surrounding sea offer a grand opening of economic importance for a large fish industry which might rival that of the Cape Colony.

The small amount of fishing carried on is with hook and line, either from the shore or from small rowing boats, which do not venture far out from the island.

The values of imports for 1880 and 1881 are returned as £54,272 and £53,169, and include £37 and £78 on account of imported fish, and £55 and £64 on account of introduced salt.

It is as well to know that St. Helena seems to be resorted to as the depôt for the American whale industry of the South Atlantic and more southern seas.

The Blue Books for the island show that there were imported by American whalers, and exported in American ships for the U.S., in 1879, 1880, and 1881, connected with this trade, bone and oil to the returned value of £32,190, £50,730, and £27,680.

In a most useful map of the world, prepared by the United States, and courteously placed at my disposal for the present occasion, there will be seen the extent and distribution of the present and abandoned American whaling grounds.

The sites which may be perhaps considered as of this paper lie approximately within 30° W. and 20° E. long., and 20° N. and 40° S. lat. The area may be estimated by the bounding degrees of Lat. and Long., and is made up of the "Cape Verde,"* "Ascension† and St. Helena,"‡ "West and South African,"§ and "African Atlantic" grounds.

While on this subject I may record the following description by the owner, Signor Ferro, of a fishing net in his possession of West African manufacture, made of the sinews of the whale, so far as one can presently judge without seeing it, as among the Cape Flattery Indians and Eskimos of North America.

"As to the net, it was brought from the Arabs of the Rio de Oro (River Ouro); it is some thirty fathoms long and one and a half fathoms deep, and of one inch mesh. It has the appearance of being made of thick guitar strings, but the Arabs explained that they made it from the intestines of a whale which stranded on the coast. The net is made without the help of either a netting needle or gunge; they tied each knot with their fingers, twisting at the same time the cord as required. Notwithstanding this laborious way of making it, the net is perfectly regular throughout. The knot used is the same as used here, which they learnt from the fishermen (of Canary). It is weighted at the bottom by round beads of red earthenware of their own manufacture, about one inch in diameter. The corks are the same size and shape as the leads (?), and made from pieces thrown up upon the shore."

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* 22° N.; 15° N. Lat. from West African shore to 30° W. Long.

† 5° and 25° S. Lat.; 3° and 10° W. Long.

‡ 5° N. Lat. and 38° S. Lat.; average breadth between 5° and 20° E. Long.

§ 30° and 40° S. Lat.; 10° E. and 25° W. Long.

There are certain local taxes under Ordinance No. 2 of 1868, which may be viewed as telling indirectly against the fish industry. I allude to the licence of fishing boats, whale boats, etc. There are no customs dues on imported fish or on salt.

Coral is remarkable for its absence, one species (*Phymactis*) being found on the coast, and two or three kinds in the surrounding seas.

With the means lying at their very door, I may say—viz., the fish, which in other countries would be, and is, turned to profitable account of considerable proportion—the inhabitants of West Africa, including her archipelagoes, are, from the want of education—may be from other additional causes—regardless of it. An industry, true, is pursued but not with the energy the field deserves.

An extensive sea-shore, rivers, and lagoons ; streams and inlets to permit of ascent of spawning fish ; absence of manufactories to pollute waters ; little traffic disturbance of the waters, present perhaps favourable conditions for the development of a large and wholesome fish trade.

Against the migration of fish however we have the action of almost a constant thundering surf in the Gulf of Guinea, and we must not forget the cataracts so often met during the dry season in West African rivers ; they are however covered with water in the "rains," and then should offer little obstacle.

Sufficient, I am sure, has been advanced in support of the fact that there is an abundance of fish.

It would seem to me that the herring, for instance, offers an industrial opening that should prove remunerative.

Professor G. Brown Goode, in his report (1877) on the American menhaden, has stated :

> "Again, on the West Coast of Africa occurs a species, *Brevoortia dorsalis*, closely resembling the menhaden. An old fisherman of Maine told me that he had seen the menhaden in immense quantities on the West Coast of Africa, where the negroes spear them and eat them."

Why should there not be a West African "Menhaden" fishery of some dimensions? Not much more than twenty years ago the American menhaden fisheries were of very small importance, and the business of the manufacture of oil and guano in its infancy. See what gigantic strides this industry has taken, and the proportions and importance it has assumed!

The plant, free from complication, for making oil and guano, on a small scale as an experiment, need not cost more than £30 or £40. The process of manufacture seems simple in the extreme, viz., boiling the fish, skimming off the floating oil, pressing (for more oil) and drying the refuse which represents the guano; there has to be also, I believe, a certain clarification of the expressed oil.

Hulks anchored outside the naval regulation distance from shore—I think three miles, so as to avoid, it is said, the effects of malaria—and thus beyond the action of the surf, might be resorted to as floating oil-factories, with the requisite supply, for fishing purposes, of hands, canoes and boats, and improved gear, to be worked as to fishermen by Krooboys or canoemen of other tribes. The industry might be associated with existing mercantile undertakings, perhaps through the medium or under the superintendence of the Masters of the many trading vessels that are to be ıd so long at one time on the coast. The small local steamers could be used during the slack trade time, if the herring season suited, in increasing the catch.

This Paper must, I would deign to hope, be therefore viewed, not as a scientific venture, nor yet as the exponent of any theories—for other demands on my time have not admitted of my following up, as closely as I should have wished, fish as a study—but rather as a convenient collection of gleanings from and references to other works bearing on the subject, and the record of my own experience.

I must acknowledge its incompleteness and imperfection, but console myself with the hope that it contains information which may have escaped others either in reading or in observation, and may form a groundwork for later, if not correction, at least elaboration and study on the part of those who can spare the time to the subject, and thus prove to be the means of attracting increased attention to that interesting and not "Expiring continent," with an ultimate issue of beneficial results, whether in the shape of addition to fish or other industries—a grand opening—or in a humanitarian sense of a more full and healthy food supply, and of consequent indirect benefit to the well-being of our People in Africa.

Yet, while I confess that this task might have fallen to better and more able hands, I will not give way in the sense of pleasure I have felt in undertaking it, feeling that it is the bounden duty of every one to promote, as far as his lights may admit, whether directly or indirectly, the condition of the people among whom his lot may be cast.

The Missionaries, in all the ramifications of their work, the Mercantile World, outside the circle of Government officials, represent means of contribution of material towards increased scientific knowledge, and it is to be hoped that an allusion to their importance as Agents in such a way may bring about fruit. West Africa however affords at present in our Possessions no magnets for the growth of scientific attraction and interest in the shape of Museums, Botanic Gardens, Herbariums or Model Farms, wants deeply felt in justice, if not to more, to its fauna and flora.

The climate of West Africa may not admit of general colonisation, nor should it be necessary, for it offers good material for development; while acknowledging it is bad, and, although such, has been often painted in the worst colours, yet it will continue to admit of the further import of commercial enterprise, resulting in more good to its undertakers and to Her People.

In the preparation of this Paper I am indebted to the courtesy and attention of many, especially to Dr. Günther of the British Museum, and to Dr. Murie of the Linnean Society, and I trust that this brief acknowledgment of my debt may be generally accepted.

DISCUSSION.

Mr. **EDWARD JEX** said the capture of barracouta and bonito on the coast of Guinea had been mentioned, but no mention was made of the manner in which they were caught; the same with regard to the herring and mackerel.

Captain **MOLONEY** said the barracouta and bonito were caught with hook and line, the herring and mackerel were caught with a circular hand-net, which, perhaps, in its closing action by weighted edge and result, might bear some slight comparison with the purse-seine net, but for a detailed description he would beg leave to refer Mr. Jex to page 24 of his Paper,* and to the miniature model before nference.

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* Page 444 of this volume.

Captain J. D. CURTIS, R.N., said he had had considerable experience on the West Coast of Africa, including the Gold Coast; with regard to the fishing, it appeared to be *nil* on the Gold Coast, for he had had the misfortune to cruise up and down there for nine months, in 1851 and 1852, and never fell in with any fishing canoe. An old messmate of his told him that in 1845 or 1848 one of the commanders there used occasionally to throw over a trawl from the brig, with which they caught sole and turbot, which, after supplying the sick, were divided between the officers and crew. On the West Coast the fish caught in the trawl were mullet, bream, and red fish, called snapper. At Loando they caught what were called snappers, or sea bream, in about sixty fathoms water, and in Elephant Bay there was abundance of grey mullet. In the Portuguese Settlements fishing was carried on by cabbage wood rafts and canoes, and there was a large establishment in Little Fish Bay for drying fish; they dried in eight or nine days in the sun, but unfortunately the wind carried the sand over them, and made them rather gritty. At Ambrizette a peculiar small double canoe is used. If the Commission could impress on the Admiralty the desirability of each ship carrying a trawl as well as the seine, there was no doubt a great deal of fish could be caught, which would be very advantageous to the crews but unfortunately many captains used to think more of their paint than anything else, and objected to fishing. He recollected on one occasion seven porpoises were harpooned in one watch. When off Lagos, a quantity of condemned pork being thrown overboard, the next day a number of large sharks were caught—not like the Arctic shark. He had no doubt wherever there was a sandy bottom fish would be found, especially at rivers' mouths. With regard to the turtles at the Ascension, they came up to lay their eggs; on their return men employed for the purpose captured them, and deposited them in the turtle ponds for use when required. They were served out as fresh-meat rations twice a week: the small ones when hatched found their way to the sea. The pond is only a depôt for keeping them; they did not breed there at all. There is a peculiar turtle found in the mouth of the Congo with a head somewhat resembling a bat's. I have not seen the kind anywhere else. Barracouta, porpoises, bonito, dolphin, sucker-fish, pilot or zebra fish, cat-fish, and pouter-fish are to be found on the Gold Coast: off the Congo, whales, thresher, sword-fish, and saw-fish. A saw-fish cut my boat's cable, a 3½-inch hawser, in two; a friend of mine had a similar misfortune off Cabenda.

Mr. JEX had been pleased to hear the remarks of Captain Curtis, showing that there were bottom fish on the coast of Africa, the Paper being mostly devoted to surface swimming or round fish.

Mr. BANDFORD GRIFFITH said he had been up and down the coast three or four times, and although twenty years ago there must have been no fishing, there were now fishing boats to be seen at all places. At Sierra Leone they came and offered fish for sale; and lower down, on the Liberia coast and at Axim, he had seen numbers of fish on shore, but they were all sharks, varying in length from one to twenty-four feet. A little above Axim there were great numbers of sword-fish, and off the Dahomean coast he had seen sword-fish twelve or fourteen feet long. At Accra he had seen fishing boats going out morning after morning and coming back in the evening; and at Lagos there were regular fishing villages, though there the fishermen did not go out beyond the surf. No doubt one reason why Captain Moloney had not referred to bottom fish was, that the people on the part of the coast he had principally dealt with rarely went out to sea, but fished chiefly in the lagoons, or within a few miles of the coast; they did not as a rule get deep-sea fish, nor in fact did they endeavour to catch large fish, for they might very often meet with sharks, which were very troublesome customers. They were much indebted to Captain Moloney for having produced such an interesting Paper with such small material available.

Captain CURTIS said it might be worth noting that on one occasion he recollected capturing a porpoise which had a squid inside of it.

Mr. SAVILLE KENT then proposed a vote of thanks to Captain Moloney. He must say that the impression on his own mind was that, if this Paper had not been read, there would have been a considerable gap left in the literature of. the Exhibition ; and they were also indebted to him for the illustrations which accompanied it. He hoped Captain Moloney would not feel that the apparent paucity of numbers was any indication of the interest felt in the Conference. He was glad to see that there were present representatives from China, Japan, the Australian Colonies, and North America, which was a more correct indication of the extent of interest taken in this Paper.

Mr. BLOOMFIELD, in seconding the motion, said they had been favoured with some remarks by a gentleman who had also been on the coast of Africa, and knew something of fishing there, but unfortunately it appeared he had been under the command of gentlemen who were not particularly favourable to that occupation. Still it appeared that they had nothing to do but throw overboard something or other, and the fish were caught, and the sick we benefited. He had, however, been able to add to the list of fish known on that coast some of which were not represented in the Exhibition. A remark was made in the Paper with reference to there not being aldermen on a certain portion of the coast where there were plenty of turtles. Of course aldermen were entitled to eat turtles, and very few other people could afford it; but, on the other hand, there was a large community not far off which at the present moment were prevented apparently by the aldermen from eating something which was a great deal cheaper than turtles. Herrings, mackerel, and all sorts of fish, might be cheaper at the present moment if an opportunity were given by certain aldermen to have those fish brought into a central market with greater facilities, so as to afford sustenance to the poor. He hoped the remarks made from time to time with reference to that point would receive the same careful attention on the part of the public which other subjects had already received. The places now described were a long distance off, but those present yesterday would remember that the gentleman from Japan had produced what looked more like a lump of stick than anything else, which was in reality a fish, so preserved as to be capable of being transported all over the world, and kept for any time, and yet it could easily be converted into a pleasant and valuable article of food. Not a Paper had been read at these Conferences but showed more or less that, however the population might increase, there would be found in every part of the globe where the flag of Great Britain floated a source of supply for the national wants, though but for this great Fisheries Exhibition a deal of this information would not have been forthcoming. He there- considered that those gentlemen who came forward id these Papers were entitled to the thanks not only of those who heard them, but of the country at large, and, in fact, of the whole civilised world.

Mr. JEX said there were thousands in the City of London besides aldermen who ate turtle; and as to stopping the fish coming to the great centres of England, it was not the aldermen but the railway carriers who were the obstacles. A gentleman wrote to him from Glasgow that he could pay the freight of a barrel of herrings to Sidney and back and have a surplus left. It was not a question of the aldermen, but of the railway ring, and he hoped the Railway Commissioners would take the matter in hand and put a stop to the heavy charges now imposed for the carriage of fish, and thus enable him to bring fish not only from Scotland but from the west coast of Ireland, where there was an immense supply.

Mr. OKOSHI said there was no doubt that this Paper had thrown great light on the fisheries of Africa. The Japanese were a great fish-eating people, and in fact a great portion of them lived on fish; they not only ate fish which were commonly used here, but some other kinds, as the octopus; and as he found from the Paper that the fish was caught in the Canary Islands, he should like to know whether it was used there as food, as it was in Japan and China. It might seem curious to Englishmen that this fish should be eaten, but he could assure them it was really very delicate.

The vote of thanks having been carried unanimously,

Captain MOLONEY, in responding, said that he had already sufficiently trespassed on the generous patience of Sir Ambrose Shea and of the audience, and therefore would be brief. It did not require, fortunately, many words to convey his appreciative acknowledgments of the terms of the vote of thanks that had been so flatteringly pronounced by Mr. Saville Kent, and of the manner in which it had been received.

In the preparation of the Paper which he had just read, he had simply done his duty by the Exhibition, but more particularly by the people amongst whom he had the honour of serving for some years. The Pamphlet might be accepted as the record of so much information in a convenient form as may have escaped others either in reading or in observation, and may prove to be the groundwork for later study and increased attraction with an outcome, he hoped, of beneficial results, whether in the way of an increase to our industries or, humanitarianly speaking, of a healthier food supply.

As to the native fishing industry in the Bights of Benin, Gold Coast, and off West Africa, Captain Curtis would be gratified to know that it had considerably increased since the time—over thirty years ago—of which he had spoken; and, in view of such a fact, Captain Moloney did not deem it necessary to modify in any way the particulars of his Paper.

Whilst thanking Captain Curtis for the further information, as regards Ascension, for which the Conference were indebted to his experience, Captain Moloney added that he had been fortunate enough at times, whilst in the Administration of the Government of Lagos, to receive from different commanders of Her Majesty's ships very fine turtle transported from the island of Ascension, where in the ponds or lakes, which were fed as previously described, he was given to believe a considerable rearing turtle industry proceeded for the benefit of the local squadron and for others, among whom he was glad to find

umbered occasionally.

rds the reference to the octopus, to which attention had been invited by Mr. Okoshi, he did not allude to its catch as a later economic food industry; it was simply caught off the coast of Western Africa, to be used as bait.

Mr. HOUNSELL then proposed a vote of thanks to the Chairman, who had occupied the platform three times that day. It was not necessary to say anything in support of the resolution, but he could not pass a higher encomium on the Chairman than by saying, what he said most cordially of himself that morning, that if at any time he could assist the work of the Exhibition by doing anything in its favour, it was a pleasure to him.

Mr. JEX seconded the motion, which was carried unanimously.

The CHAIRMAN said it was to him a very grateful duty to have had the opportunity of assisting in any way the object for which the Exhibition was established.

List of Memoirs dealing specially with the Crustacean-Fauna of the West Coast of Africa (North of Tropic of Capricorn) and the Islands of the same sub-region—for which I am indebted to Mr. E. J. Miers, of the British (Natural History) Museum.

Studer, Th.—Verzeichniss der Crustaceen, welche während der Reise S. M. S. Gazelle an der West-Kuste von Africa, Ascension, und der Cap der Guten Hoffnung gesammelt wurden. pp. 1–32, pls. i., ii. Berlin, 1883. 4to.

E. J. Miers.—On a collection of Crustacea made by Baron H. Maltzan at Goree Islands, Senegambia. Annals and Mag. of Nat. Hist. (ser. 5) viii. pp. 204–220, 259–281, 364–377. pls. xiii.–xvi. (1881.)

Dr. A. G. Günther.—On a collection of Crustacea made by Mr. T. Coury in Ascension Island (*crustacea by E. J. Miers*). Annals and Mag. of Nat. Hist. (ser. 5) viii. pp. 432–434. (1881.)

A. M. Edwards.—"Description de quelques espèces nouvelles de Crustacés provenant du Voyage aux Iles du Cap Vert de Mdlle. Bouvier et de Cessac." Bulletin de la Société Philomathique de Paris. pp. 3–13. (1878.)

Crustacea by *C. Spence Bate*, F.R.S., in the work on St. Helena by J. C. Melliss. London. 8vo. 1875.

A. Milne-Edwards.—"Description de quelques espèces nouvelles de Crustacés provenant du Voyage de M. A. Bouvier aux Iles du Cap Vert." Revue et Magasin de Zoologie, pp. 350–355, 374–378, 409–412. (1869.)

A. Milne-Edwards.—"Observations sur la Faune carcinologique des Iles du Cap Vert." Nouvelles Archives du Muséum. pp. 49–60, pls. 16–18. (1868.)

F. de B. Capello.—Descripção de tres especies novas de Crustaceos da Africa occidental; &c. Lisboa. 1867. 4to.

lots, J. A.—Additamenta ad Faunam Carcinologicam Africae cidentalis, &c. Leyden. 4to. (1851.)

MM. Barker-Webb & S. Berthelot. Histoire naturelle des Iles Canaries; Zoologie, vol. ii.
Crustacés by *M. Brullé.* Paris. 4to. (1835–44.)

Besides the special memoirs included in the above list, certain species are incidentally referred to in works and memoirs not specially devoted to the West African fauna, some of these are mentioned by Dr. Studer in the introduction to his memoir cited above. A species especially worthy of mention as eaten by the natives of the Camaroons (where it appears in prodigious numbers in the rivers) is *Callianassa turnerana,* a macrurous fossorial Crustacean. White described and excellently figured this species in the Proceedings of the Zoological Society, 1861, p. 42, pl. vi.

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